1. SCOPE

1.1 PURPOSE. This specification establishes the test requirements for repaired GFP LEM Power and Servo Assemblies, hereafter called the PSA, which have been returned for repair or replacement of nonconforming subassemblies.

1.2 DEVIATIONS. Deviations from the requirements of this specification are premitted without waivers only as specified in the Apollo Repair Retest Order (ARRO) and as authorized by NASA/RASPO.

2. APPLICABLE DOCUMENTS

2.1 EFFECTIVE ISSUES. The following documents form a part of this specification to the extent specified herein.

SPECIFICATIONS

APOLLO G&N

ND1002214	General Specification for Preservation, Packaging, Packing and Container Marking of APOLLO Guidance and Navigation Major Assemblies, Assemblies, Subassemblies, Parts and Associated Ground Support Equipment
PS6007200	Procurement Specification, Product Configuration and Acceptance Test Requirements, Power and Servo Assembly, Drawing No. 6007200

DRAWINGS

APOLLO G&N

6007003	Header Assembly PSA (LEM)

2/1/67

APOLLO G&N Specification
ND1002310 REV –
Original Issue Date: 23 FEB 67
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Class A Release
CODE IDENT NO. 80230

GFP RETEST SPECIFICATION

FOR

SIGNAL CONDITIONER ASSEMBLY

LEM FLIGHT-QUAL

DRAWING NO. 6007010

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals MIT	Approvals NASA

This specification consists of page 1 to 6 inclusive.

APPROVALS	NASA/MSC	R M Kowalski 14 Feb 67	MIT/IL CCB	W H Piotrowski 13 January 1967 ACSP

Table 631-1

CRT Error Display Definition

Error or Discrete	CRT Display	K-START Module Display	Command Tape Exit
Odd parity does not exist in the data frame received from K-START module.	PARERR 1	Non-Verify	631, PARERR 1, Time, Ref.
An invalid GC keycode has been received by this sub-program.	KEYERR 1	Non-Verify	631, KEYERR 1, Time Ref.
An illegal entry of a V36E has occurred.	KEYERR 2	Non-Verify	631, KEYERR 2, Time Ref.
No Keycodes can be received by the GC via Uplink, therefore further keycode entry through the K-START is inhibited.	BLOCK UPLINK ON*	Non-Verify**	631, Block Uplink, Time Ref.
This indicates that an incorrect keycode loading procedure has occurred and entry through the K-START is inhibited.	OPERATOR ERROR ON*	Non-Verify	631, Op. Error, Time Ref.

* These CRT discrete displays are set by G&N 224A, 624A, 624B or 624-200 ACE-S/C Downlink Interpretation Program.

** A verify display will occur if the R-START "Block Uplink Override" has been executed.

APOLLO G&N Specification
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ACE-S/C COMPUTER SUBPROGRAM
SPECIFICATIONS FOR APOLLO
CM AND LM G & N TESTING

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
				AC	NASA
7/27/67	H	34236	3, 268, 335, 336, 347, 351,	EA	---
			354, 355, 356, 358. Was 392		
			pages; now 398 pages. RDG/IRC		
8/31/67	J	34461	3, 317, 319, 328, 331, 342, 381,	EA	---
			382 RDG/IRC		
9/14/67	K	34608	378, 379	EA	--
9/21/67	L	34655	354-356, 358 RDG/IRC	EA	--
2/1/68	M	35548	3, 235-398; was 398 pages, now	EA	--
			432 pages.		

This specification consists of page 1 to 432 inclusive.

APPROVALS	NASA/MSC	MIT/IL	AC

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221A	AGC Downlink Format Program Block 2	4-221A.1
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Title: Quick Look for G&N DOWNLINK Data G&N 711A.

Purpose: To provide a prompt print out of the data filed by the G&N Subprogram on the UPLINK file tape.

Calling Sequence: Entry: This program operates under Executive Control and shall be initiated from the C-START Module.

Data: Input: The data utilized by this subprogram consists of the G&N data filed as DYNAMES on the UPLINK file tape.

Output: The output will consist of the following:

1) Print out of any one file of data.
2) Print out of all G&N data starting at a given range time and continuing in increments of one minute to a specified stop time.

Normal Exit: Return to Executive Program Control.

Error Exit: None required.

Computation Sequence:

1) This program will be stored on the master program tape and will be loaded into the ADAP memory section upon initiation from a C-START module.
2) The printout shall be considered low priority and shall not interrupt downlink compressed tape filing or the ACE station displays.
3) The programs shall automatically terminate if any UPLINK commands are transmitted.
4) Upon completion of the print out or emergency termination, the ADAP memory shall be available for other ADAP sequences or load and go programs.
5) The program shall convert the output data from the uplink file tape and print it thru the downlink computer. The program shall have the option of utilizing the available downlink compressed data tape drive.
6) The program shall translate DYNAMES records that have been stored by G&N DOWNLINK programs. These are DYNAMES 5 thru 15 inclusive and shall interpret each of these as follows:

TYPE		PRINTER OUTPUT	
DYNAMES 5	SYNCERR 1	WDCNT XXX_{10}	XXX_8 XXX_8
DYNAMES 6	SYNCERR 2	WDCNT XXX_{10}	XXX_8 XXX_8
DYNAMES 7	MARKERR 1	WDCNT XXX_{10}	XX_{10}
DYNAMES 8	MARKERR 2	WDCNT XXX_{10}	XXX_8 XXX_8
DYNAMES 9	WORDERR 1	WDCNT XXX_{10}	XXX_8 XXX_8 XXX_8 XXX_8 XXX_8
DYNAMES 10	WORDERR 2	WDCNT XXX_{10}	XXX_8 XXX_8
DYNAMES 11	RELERR 1	WDCNT XXX_{10}	XX_8 XX_8
DYNAMES 12	R1 SXXXXX R2 SXXXXX	R3 SXXXXX	NOUN XX VERB XX PROG XX FX
DYNAMES 13	INO	XX_8	
DYNAMES 14	LX $WXXX_{10}$ $SX_1X_2 \ldots X_N$;	$WXXX_{10}$	$SX_1X_2 \ldots X_N$; $N \leq 9$
DYNAMES 15	WORDERR X	WDCNT XXX_{10}	XXX_8 XXX_8 XXX_8 XXX_8 XXX_8

Where WDCNT XXX or WXXX is the word number in decimal; the data field for DYNAMES 5, 6, 8, 9, 10, 11, 13, and 15 is octal; the data field for DYNAMES 7, 12, and 14 may be decimal; the sign position for DYNAMES 12 and 14 can be plus, minus or blank.

7) DYNAMES 14 records shall be printed with up to five records per line. The list number will appear only once per line. The DYNAMES 14 records will be printed on the same line provided they are consecutive printable records on the uplink file tape. A new line will be started each time the word number is equal to or less than the previous word number or a record other than DYNAMES 14 appears on the tape.

8) The program shall have the option to ignore DYNAMES types 12 and 14.

Operator Action:

1) The computer room console operator must make the proper C-START entries. To obtain a time interval printout the following C-START entries must be made:

a) 8DDDHHMMII

Where DDD is day (001-999) if 000 no day search.
HH is hour (00-23)
MM is minutes (00-59)
II is delta (00-99) minutes of data to be printed.

1) (continued)

b) 7-2STNN40X

S = (+) Perform shutdown and write End of File before beginning search.

S = (-) Do not perform shutdown or write an End of File before beginning search.

NN is the file or files to be translated (01-99)

NN = 00 indicates time search

T = 0 Means strip DYNAMES 5-15 from file located (NN) files previous to the "END OF TEST" record

T = 1 Same as T = 0 except exclude DYNAMES 12 and 14.

T = 2 Means strip DYNAMES 5-15 (NN) files previous to the "END OF TEST" record to the "END OF TEST" record.

T = 3 Same as T = 2 except exclude DYNAMES 12 and 14.

To perform the printout by files the C-START entry 8DDDHHMMII is not required.

2) The computer room console operator shall notify the test conductor that no uplink activity (except for emergency) shall occur during execution of the program. The program will automatically terminate if any UPLINK activity occurs.

3) Upon completion of the program, the computer room console operator shall notify the test conductor that normal UPLINK activity can be resumed.

Title: Downlink Format and Interpretation Subprogram G&N 721

Part Of: Downlink Program

Purpose: The subprogram accepts each block of five 8-bit G&N T/M words (G&N Computer Data), reformats the block into two 16-bit G&N Computer words and checks parity. A check for the correct data sequence and a valid ID Block is also made. After these checks, the 16-bit words are available for interpretation as defined on the Downlink Requirements Cards or routed to subprogram G&N 722 for further processing. If any of the checks fail, an error flag is set.

Calling Sequence:

Entry: This subprogram operates under Downlink Executive Program Control and is initiated upon receipt of an Executive Program interrupt.

Data:

Input:
(a) A sequence of five 8-bit G&N T/M words (one block) is received each prime frame. The number of blocks for each downlist and the content of each block will be specified on the Downlink Requirements Cards. The first block in a downlist will be the ID block which identifies which downlist is to be processed.

(b) Notification upon loss of a block (Prime Frame).

Output:
(a) Valid data is available for interpretation as specified on the Downlink Requirements Cards or transmitted to ACE-S/C Subprogram G&N 722 for further processing and display.

(b) Error conditions will be displayed and recorded.

Normal Exit: Return to Executive Program Control.

Error Exit: None.

Computation Sequence:

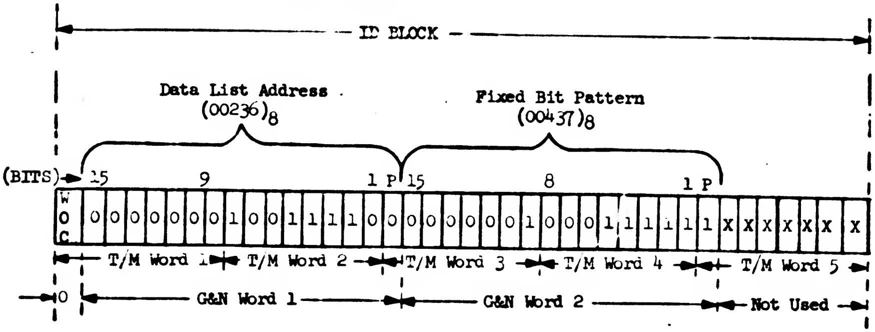
General: The program receives blocks of five 8-bit T/M words, with the following configuration:

WORD 1	WOC	15	14	13	12	11	10	9
WORD 2	8	7	6	5	4	3	2	1
WORD 3	P	15	14	13	12	11	10	9
WORD 4	8	7	6	5	4	3	2	1
WORD 5	P	X	X	X	X	X	X	X

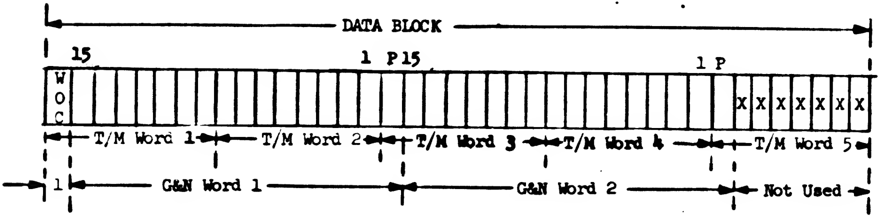
Where WOC = Word order code (1-bit)
P = Parity (G&N words have odd parity)
X = Not used

The ID block contains a zero WOC, two 16-bit words including parity bits (P) and seven unused bit positions (X). Word 1 contains the data list address in bit positions 15-1 and parity (P) in bit position zero.

Word 2 contains a fixed bit pattern sync word $(00437)_8$ in positions 15-1 and Parity (P) in bit position zero. Word 1 precedes Word 2 in the data block transmission. The word order code (WOC) bit contains a 0 for all ID blocks. An example of the ID block and word format is shown below:



The data blocks contain a WOC, two 16-bit words including parity bits (P) and seven unused bit positions (X). Word 1 precedes Word 2 in the data block transmission. The word order code (WOC) bit contains a 1 for all Data Blocks. An example of the Data Block and word format is shown below:



The G&N Computer downlist content is specified on the Downlink Requirements Cards referenced by the ID word. The position of the G&N Computer word in each fixed length list determines whether the word is to be used for data monitoring and processing or sent to G&N 722 for DSKY display monitoring.

Logic Sequence:

1. Upon initial entry, for a decommutator "loss of sync" or under conditions as specified in steps 3 and 4 below, wait for an ID block which has a word order code of 0 then initialize a word counter. If no requirement for this step, proceed to step 2.

2. Under normal conditions or successful completion of step 1 above, check parity of both the 1st and 2nd G&N Computer words of the block. If this check fails, display WORDERR 1 and file WORDERR 1 with the information defined under filing requirements. Proceed to step 3.

3. For a WOC = 0, perform ID check for:

   a. Correct data list address in bits 1-15 of 1st word in the ID block.

   b. $(00437)_8$ in bits 1-15 of the 2nd word in the ID block.

If either of the above checks fail, display WORDERR 2 and file WORDERR 2 with information defined under filing requirements. Return to wait routine specified in step 1 above.

If ID check passes, check that an ID block has not been received too soon.

If it has been received too soon, display SYNCERR 2 and file SYNCERR 2 with the information defined under filing requirements and proceed as if it had been in the correct sequence. If the ID block is received in the correct sequence, initialize the word count for processing data blocks and return to Exec. program control.

4. For a WOC ≠ 0, use word count to determine if an ID was expected. If it was, display SYNCERR 1 and file SYNCERR 1 with the information defined under Filing Requirements. Return to 'wait routine' specified in step 1 above. If no ID block was expected, proceed to step 5.

5. DSPTAB words +0 thru +10D are to be sent to G&N 722 along with the identifier after taking the ones complement of the DSPTAB word if bit 15 is a one (1). All other words are to be processed per the Downlink Requirements Cards.

6. When G&N Computer power is off, all bits in the T/M word blocks will be zero causing a constant WORDERR 1 and 2 display. If this condition exists, the error should be filed only once per minute.

7. When the G&N Computer is in STANDBY, all the bits in the T/M word blocks will be ONES, causing a constant WORDERR 1 and SYNCERR 1 display. If this condition exists, the error should be filed once per minute.

Downlink Requirements:

Measurement ID:	Specified on the Downlink Requirements Cards.
Display:	This information is detailed in the computational sequence description and consists of program error displays as specified in Table 721-1. The Downlink Requirements cards shall contain the display requirements.
Filing:	Upon detection of an error, the appropriate information is recorded on the file tape as specified in Table 721-1.

TABLE 721-1

ERROR DESCRIPTION	DISPLAY	FILE TAPE
This indicates that Word count has incremented beyond a specified limit, with no ID word detected.	SYNCERR 1	SYNCERR 1, Time Tag reference, Word Count, ID block.
At this point Word Count has not reached its specified limit, but an ID block has been received.	SYNCERR 2	SYNCERR 2, Time Tag Reference Word count, ID block.
Parity is incorrect in the 1st or 2nd G&N Computer word of either an ID Block or a Data Block.	WORDERR 1	WORDERR 1, Time Tag Reference, Block count, ID or Data Block containing the parity error.
The content of the ID block is not correct.	WORDERR 2	WORDERR 2, Time Tag Reference, Word count ID Block.

Title: Downlink Format and Interpretation Program G&N 721A

Part Of: Downlink Program

Purpose: The program accepts each block of five 8-bit G&N T/M words (G&N Computer Data), reformats the block into two 16-bit G&N Computer words and checks parity. A check for the correct data sequence and a valid ID Block is also made. After these checks, the 16-bit words are available for interpretation as defined on the Downlink Requirements Cards or routed to program G&N 722 for further processing. If any of the checks fail, an error flag is set.

Calling Sequence:

Entry: This program operates under Downlink Executive Program Control and is initiated upon receipt of an Executive Program interrupt.

Data: Input:

(a) A sequence of five 8-bit G&N T/M words (one block) is received each prime frame. The number of blocks for each downlist and the content of each block will be specified on the Downlink Requirements Cards. The first block in a downlist will be the ID block which identifies which downlist is to be processed.

(b) Notification upon loss of a block (Prime Frame).

Output:

(a) Valid data is available for interpretation as specified on the Downlink Requirements Cards or transmitted to ACE-S/C Program G&N 722 for further processing and display.

(b) Error conditions will be displayed and recorded.

Normal Exit: Return to Executive Program Control.

Error Exit: None.

Computation Sequence:

General:

The program receives blocks of five 8-bit T/M words, with the following configuration:

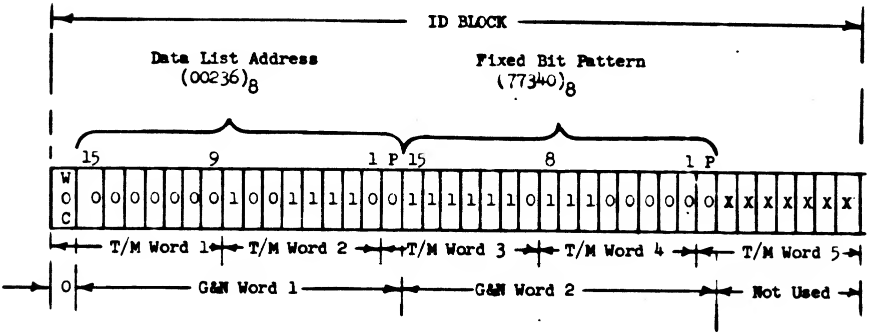
WORD 1	WOC	15	14	13	12	11	10	9
WORD 2	8	7	6	5	4	3	2	1
WORD 3	P	15	14	13	12	11	10	9
WORD 4	8	7	6	5	4	3	2	1
WORD 5	P	X	X	X	X	X	X	X

Where WOC = Word order code (1-bit)

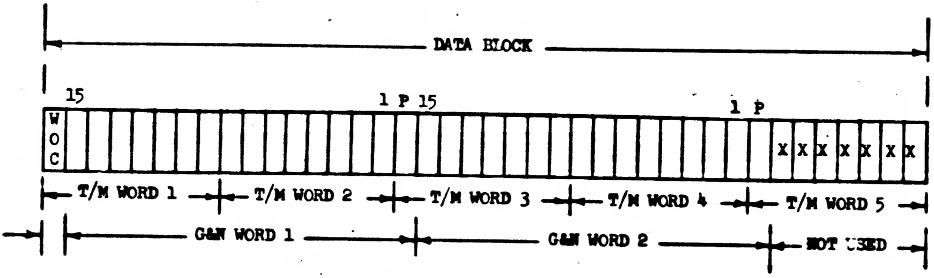
P = Parity (G&N words have odd parity)
X = Not used

The ID block contains a zero WOC, two 16-bit words including parity bits (P) and seven unused bit positions (X). Word 1 contains the data list address in bit positions 15-1 and parity (P) in bit position zero.

Word 2 contains a fixed bit pattern sync word (77340_8 or 00437_8) in positions 15-1 and Parity (P) in bit position zero. Word 1 precedes Word 2 in the data block transmission. The word order code (WOC) bit contains a 0 for all ID blocks. An example of the ID block and word format is shown below:



The data blocks contain a WOC, two 16-bit words including parity bits (P) and seven unused bit positions (X). Word 1 precedes Word 2 in the data block transmission. The word order code (WOC) bit contains a 1 for all Data Blocks except Data Block 51 when the fixed bit pattern of the ID word is 77340_8. An example of the Data Block and word format is shown below:



The G&N Computer downlist content is specified on the Downlink Requirements Cards referenced by the ID word. The position of the G&N Computer word in each fixed length list determines whether the word is to be used for data monitoring and processing or sent to G&N 722 for DSKY display monitoring.

Logic Sequence:

1. Check parity of both the 1st and 2nd G&N Computer words of the block. If this check fails, do not process the words but display and file WORDERR 1 as defined in Table 721-1 and wait for the next word block. If three successive WORDERR 1's are obtained, inhibit filing data until a valid ID word is received. If, while processing a valid list, the 40 bits are all zeros, a G&N Computer restart has occurred. If this condition is obtained, display WORDERR 4 and file each succeeding block of data as WORDERR 4 as specified in Table 721-1 until a valid WOC=0 is obtained.

2. For a decommutator "loss of sync", wait for an ID block or data block 51 which has a Word Order Code (WOC) of zero, then initialize a word counter. A data block 51 with a WOC = 0 shall only be accepted if previous processed data had a fixed bit pattern of 77340_8.

3. Check that the number of words received is not greater than the list length. If so, display SYNCERR 1 and file SYNCERR 1 as defined in Table 721-1 and wait until a valid ID word is received.

4. For a WOC = 0, perform ID check for:

   a. Correct fixed bit sync word of 77340_8 in bits 1-15 of 2nd word in block.

   b. Correct fixed bit sync word of 00437_8 in bits 1-15 of 2nd word in block.

   c. Correct data list address in bits 1-15 of 1st word in block.

5. If steps 4a and 4c or 4b and 4c above are correct, set an indicator to specify the type of fixed bit sync word to be processed and proceed with step 6. If incorrect proceed with step 7.

6. Check that a valid ID word has not been received too soon. If it has, display and file SYNCERR 2 as defined in Table 721-1 and proceed as if it had been received in the correct sequence. Proceed with step 9.

7. If steps 4a and 4c or 4b and 4c above fail, check to see if this should be a block 51 with a WOC = 0. If not, display and file WORDERR 2 as defined in Table 721-1 and return to step 1 above. If this is block 51 data, proceed with step 9, otherwise assume this is block 51 data, display a WORDERR 3 and file this data. Proceed with step 9.

8. For a WOC $\neq$ 0, check if this should be block 51 data with a WOC = 0. If so display and file SYNCERR 1 as specified in Table 721-1 and return to step 1 above.

9. DSPTAB words +0 through +10D are to be sent to G&N 722 along with the identifier after taking the ones complement of the DSPTAB word if bit 15 is a one (1). All other words are to be processed per the Downlink Requirements Cards.

10. When G&N Computer power is off, all bits in the T/M word blocks will be zero or when the G&N Computer is in Standby, all bits will be ones causing a constant WORDERR 1. When this condition exists, three successive WORDERR 1 displays are obtained so return to step 1.

Downlink Requirements:

Measurement ID:	Specified on the Downlink Requirements Cards.
Display:	This information is detailed in the computational sequence description and consists of program error displays as specified in Table 721-1. The Downlink Requirements cards shall contain the display reouirements.
Filing:	Upon detection of an error, the appropriate information is recorded on the file tape as specified in Table 721-1.

TABLE 721-1

ERROR DESCRIPTION	DISPLAY	FILE TAPE
This indicates that word count has incremented beyond a specified limit, with no ID word detected or beyond the limit for data block 51 (if req.).	SYNCERR 1	SYNCERR 1, Time Tag Reference, Block Count, 5 eight bit TM words.
At this point Word Count has not reached its specified limit, but an ID block has been received.	SYNCERR 2	SYNCERR 2, Time Tag Reference, Block count, 5 eight bit TM words.
Parity is incorrect in the 1st or 2nd G&N Computer word of either an ID Block or a Data Block.	WORDERR 1	WORDERR 1, Time Tag Reference, Block Count, 5 eight bit TM words.
The content of the ID block is not correct.	WORDERR 2	WORDERR 2, Time Tag Reference, Block count, 5 eight bit TM words.
The data being processed was resynced from block 51.	WORDERR 3	WORDERR 3, Time Tag Reference, Block Count, 5 eight bit T/M Words.
Data is not being processed because of a WORDERR 1	WORDERR 4	WORDERR 4, Time Tag Reference, Block Count, 5 eight bit T/M Words.

Title: Display Program (DSPTAB) G&N 722

Part of: Downlink Program

Purpose: The Display Program interprets all DSPTAB words that are detected as such by the Downlink Format Program and generates displays identical in content and format to the on-board spacecraft DSKY displays. This program provides ACE-S/C ground station test personnel the capability of continuously monitoring all spacecraft keyboard displays.

Calling Sequence:

Entry: This program is activated only by the Downlink Format Program whenever program display words are to be interpreted.

Data: Input: Inputs to the Display Program shall consist of a complete 16-bit Downlink DSPTAB word and identifier.

Output: Coded information to be displayed.

Normal Exit: Return to the ACE Executive Program.

Error Exit: Error conditions shall cause error information to be displayed and recorded on the file tape. After error recording, control is returned to the ACE Executive Program. Error messages are detailed in Table 722-3.

Computation Sequence: Activation of the Display Program is attained via the Downlink Format Program. Inputs to this program will be the 16-bit Downlink word and an identifier. The identifier specifies which DSPTAB word in the Downlink list is to be processed.

The 16-bit Downlink DSPTAB word consists of four parts of coded information plus a parity bit. The four parts are:

1. Bits 15-12: The address in these bits is not used.
2. Bit 11: The special code in this bit specifies a particular discrete associated with the DSPTAB word.

3. Bits 10-6: Represent Display Codes which are associated with specific Display Names. These codes specify the numeric character to be displayed in accordance with Table 722-2.

4. Bits 5-1: Same as bits 10-6 above.

Since the contents of the DSPTAB table is sequentially transmitted Downlink, the Downlink Format Program shall supply this subprogram with the DSPTAB contents (display word) and identifier. The display word associated with each DSPTAB is defined in Table 722-1.

Upon entry from the Downlink Format Program, the display program shall check the identifier to determine which of the 11 DSPTAB words has been received.

The Logic sequence for the DSPTAB Words depends on the state of bit 11. Below is a brief description of the action to be taken.

DSPTAB	DSPTAB WORD ACTION
+2, +8, +9D or +10D	The special code bit (bit 11), of these 4 DSPTAB words, is not applicable, therefore perform sequence 1 as described below.
+7	Bit 11 is not applicable, therefore perform sequence 2 as described below.
+1, +4, or +6	Bit 11 of these DSPTAB words is interpreted as follows: Bit 11 = 1, Set sign indicator of R to plus. Bit 11 = 0, do not change the sign indicator of R. Perform sequence 1 as described below.
+0, +3 or +5	Bit 11 of these DSPTAB words is interpreted as follows: Bit 11 = 1, set sign indicator of R to minus. Bit 11 = 0, set sign indicator of R to blank. Perform sequence 1 as described below.

NOTE: With DSPTAB +5 and +6 set the sign of R1;
DSPTAB +3 and +4 set the sign of R2;
DSPTAB +0 and +1 set the sign of R3.

Sequence 1 - extracts the relay code corresponding to bits 10-6 of the Downlink word and checks it against Table 722-2 for legality. If the code is legal the indicator is set to display the digit from Table 722-2 followed by a transfer to sequence 2. If the code is not legal clear the sign display indicator and initiate a relay-error exit. (See Table 722-3)

Sequence 2 - extracts the relay code corresponding to bits 5-1 and checks it against Table 722-2 for legality. If the code is legal the indicator is set to display the digit from Table 722-2 followed by a return to the ACE Executive Program. If the code is not legal, clear the sign and first digit display indicators and initiate a relay-error exit. (See Table 722-3)

Option - at the option of the operator an R-START may be used to transcribe the entire display on to the file tape. This R-START will be interrogated after the processing of the 11th display word. If the R-START is selected and the CRT display has changed since the last recording, the entire display is to be recorded (including FLASH and UPLINK indicators). If either the R-START is not selected or the display has not changed, no recording should be made. The recording should be prefaced by 722 Display Recording.

Operator Action:

Console Operator:	The operator shall have the option of transcribing the entire display on file tape by use of an R-START as explained under "option" of the "Computation sequence".

Downlink Requirements:

Display:	Display the results of the "computation sequence" sequence 1 and 2.
Filing:	The results of this subprogram shall be filed as explained in the "computation sequence".

TABLE 722-1

TABLE OF DISPLAY WORDS

DSPTAB	Address Bits 15-12 Binary Code	Special Code Bit 11	Display Name Relay Code for Bits 10-6	Display Name Relay Code for Bits 5-1
+10D	N	- -	MD1	MD2
+ 9D	O	- -	VD1	VD2
+ 8D	T	- -	ND1	ND2
+ 7		- -	- -	R1D1
+ 6	U	+R1	R1D2	R1D3
+ 5	S	-R1	R1D4	R1D5
+ 4	E	+R2	R2D1	R2D2
+ 3	D	-R2	R2D3	R2D4
+ 2		- -	R2D5	R3D1
+ 1		+R3	R3D2	R3D3
+ 0		-R3	R3D4	R3D5

TABLE 722-2

5 BIT RELAY CODES FOR NUMERIC CHARACTER DISPLAY

CODE	CHARACTER
00000	BLANK
10101	0
00011	1
11001	2
11011	3
01111	4
11110	5
11100	6
10011	7
11101	8
11111	9

TABLE 722-3

ERROR DESCRIPTION	DISPLAY	FILE TAPE
A word has appeared containing a relay code which is not in Table 722-2.	RELERR1	722 RELERR1, 16-bit word, time tag, and DSPTAB number.

Title: Display Program (DSPTAB) G&N 722A.

Part Of: Downlink Program

Purpose: The Display Program interprets all DSPTAB words that are detected as such by the Downlink Format Program and generates displays identical in content and format to the on-board spacecraft DSKY displays. This program provides ACE-S/C ground station test personnel the capability of continuously monitoring all spacecraft keyboard displays.

Calling Sequence:

Entry: This program is activated only by the Downlink Format Program whenever program display words are to be interpreted.

Data: Input: Inputs to the Display Program shall consist of a complete 16-bit Downlink DSPTAB word and identifier.

Output: Coded information to be displayed.

Normal:Exit: Return to the ACE Executive Program.

Error Exit: Error conditions shall cause error information to be displayed and recorded on the file tape. After error recording, control is returned to the ACE Executive Program. Error messages are detailed in Table 722-3.

Computation Sequence: Activation of the Display Program is attained via the Downlink Format Program. Inputs to this program will be the 16-bit Downlink word and an identifier. The identifier specifies which DSPTAB word in the Downlink list is to be processed.

The 16-bit Downlink DSPTAB word consists of four parts of coded information plus a parity bit. The four parts are:

1. Bits 15-12: The address in these bits is not used.
2. Bit 11: The special code in this bit specifies a particular discrete associated with the DSPTAB word.

3. Bits 10-6: Represent Display Codes which are associated with specific Display Names. These codes specify the numeric character to be displayed in accordance with Table 722-2.

4. Bits 5-1: Same as bits 10-6 above.

Since the contents of the DSPTAB table is sequentially transmitted Downlink, the Downlink Format Program shall supply this subprogram with the DSPTAB contents (display word) and identifier. The display word associated with each DSPTAB is defined in Table 722-1.

Upon entry from the Downlink Format Program, the display program shall check the identifier to determine which of the 11 DSPTAB words has been received.

The Logic Sequence for the DSPTAB Words depends on the state of bit 11. Below is a brief description of the action to be taken.

DSPTAB	DSPTAB WORD ACTION
+2, +8, +9D or +10D	The special code bit (bit 11), of these 4 DSPTAB words, is not applicable, therefore perform sequence 1 as described below.
+7	Bit 11 is not applicable, therefore perform sequence 2 as described below.
+1, +4, or +6	Bit 11 of these DSPTAB words is interpreted as follows: Bit 11 = 1, Set sign indicator of R to plus. Bit 11 = 0, do not change the sign indicator of P. Perform sequence 1 as described below.
+0, +3 or +5	Bit 11 of these DSPTAB words is interpreted as follows: Bit 11 = 1, set sign indicator of R to minus. Bit 11 = 0, set sign indicator of R to blank. Perform sequence 1 as described below.

NOTE: With DSPTAB +5 and +6 set the sign of R1;
DSPTAB +3 and +4 set the sign of R2;
DSPTAB +0 and +1 set the sign of R3.

Sequence 1 - extracts the relay code corresponding to bits 10-6 of the Downlink word and checks it against Table 722-2 for legality. If the code is legal the indicator is set to display the digit from Table 722-2 followed by a transfer to sequence 2. If the code is not legal clear the sign display indicator and initiate a relay-error exit. (See Table 722-3)

Sequence 2 - extracts the relay code corresponding to bits 5-1 and checks it against Table 722-2 for legality. If the code is legal the indicator is set to display the digit from Table 722-2 followed by a return to the ACE Executive Program. If the code is not legal, clear the sign and first digit display indicators and initiate a relay-error exit. (See Table 722-3)

Filing - After the processing of the eleventh display word and if the CRT display has changed since the last recording, the entire display is to be recorded (including FLASH). The recording should be prefaced by 722 Display Recording.

Option - At the option of the operator, an R-START may be activated to inhibit the filing of the entire display on the file tape.

Operator Action:

Console Operator: The operator shall have the option to inhibit transcribing the entire display on file tape by use of an R-START as explained under "option" of the "Computation sequence".

Downlink Requirements:

Display: Display the results of the "computation sequence" sequence 1 and 2.

Filing: The results of this subprogram shall be filed as explained in the "computation sequence'.

TABLE 722-1

TABLE OF DISPLAY WORDS

DSPTAB	Address Bits 15-12 Binary Codes	Special Code Bit 11	Display Name Relay Code for Bits 10-6	Display Name Relay Code for Bits 5-1
+10D	N	- -	MD1	MD2
+ 9D	O	- -	VD1	VD2
+ 8D	T	- -	ND1	ND2
+ 7		- -	- -	R1D1
+ 6	U	+R1	R1D2	R1 D3
+ 5	S	-R1	R1D4	R1D5
+ 4	E	+R2	R2D1	R2D2
+ 3	D	-R2	R2D3	R2D4
+ 2		- -	R2D5	R3D1
+ 1		+R3	R3D2	R3D3
+ 0		-R3	R3D4	R3D5

TABLE 722-2

5 BIT RELAY CODES FOR NUMERIC CHARACTER DISPLAY

CODE	CHARACTER
00000	Blank
10101	0
00011	1
11001	2
11011	3
01111	4
11110	5
11100	6
10011	7
11101	8
11111	9

TABLE 722-3

ERROR DESCRIPTION	DISPLAY	FILE TAPE
A word has appeared containing a relay code which is not in Table 722-2.	RELERR1	722 RELERR1, 2-five bit Relay Codes, time tag, and DSPTAB number.

Title: G&N Downlink Processing Requirements, G&N 724.

Purpose: This subprogram defines the handling, processing and filing requirements for the G&N Downlink words.

Computation Sequence: The processing requirements for the G&N computer downlink words will be specified on the Downlink Requirements cards in the PRPS or PRD. The following lists the types of processing to be available for G&N computer downlink words:

A. Events

1. Single event display where either a "0" or a "1" (normal or inverted) will be the off state of the event.

2. "ANDed" where two or more normal or inverted events may be "ANDed" for a single display. (i.e. $A \cdot \overline{B} \cdot C$)

3. "ORed" where two or more normal or inverted events may be "ORed" for a single display. (i.e. $A + \overline{B} + \overline{C} + D$)

4. Store value for G&N 722 or 732 and set "Flash" VERB/NOUN if the bit is ON or stop "Flash" if bit is OFF.

5. Store bits for G&N 731 use. (Uplink)

B. Binary Conversion

1. Display the bit specified in binary. (i.e. a "0" or a "1").

C. Octal Conversion

1. The 15 bits are converted to 5 octal digits.

D. Decimal Conversion

1. The 15 bits are considered unsigned, converted to decimal and multiplied by a specified scale factor.

2. The 15 bits are considered signed, converted to decimal and multiplied by a specified scale factor.

D. (continued)

3. The 15 bits are converted to decimal either signed or unsigned for which two scale factors apply. The scale factor to be used is determined by an event.

4. Offset Data - Two scale factors are involved. Two card sets shall be required with one card set containing the octal value (5 digits) which represents the zero condition and the other card set containing the normal scale factor. This is to be treated as a unsigned 15 bit word.

   If the G&N Computer word is greater than or equal to the offset value (zero condition), subtract the offset value from the G&N Computer word, convert to decimal and multiply by the normal scale factor. If the G&N Computer Word is less than the offset value, add the 2's compliment of the offset value to the G&N Computer word, convert to decimal and multiply by the normal scale factor.

E. Double Precision Conversion (i.e. 30 bits treated as a single word).

1. A double precision word is converted to decimal and multiplied by a specified scale factor.

2. A double precision word is converted to decimal for which two scale factors apply. The scale factor to be used is determined by an event.

3. A double precision word is converted to hours, minutes and seconds with the value of the LSB equal to 10 milliseconds. The display shall be XX HRS XX MIN XX.XX SEC. The time for G&N 701 (Uplink) shall be identified.

4. Since the sign of the LSB may not necessarily agree with the sign of the MSB, the following equation is given as a representative method of converting:
   $\left[+16384 * (\mathrm{MSB})_{10} + (\mathrm{LSB})_{10}\right] * \mathrm{Scale}$ Factor = Double Precision Answer where the sign of both the LSB and MSB must be used.

F. Miscellaneous

1. Digit Configuration - The digit configuration of the word to be displayed shall define the total number of decimal or octal (5 or 3) digits to be displayed and if the word to be displayed is decimal, the number of digits to the right of the decimal point. If the word is larger than the display called out, the most significant digits shall be truncated. Whenever the most significant digits of a decimal number are trunicated for CRT display and the trunicated digits are not equal to zero, the display on the CRT shall blink.

2. Filing - the "File Flag" shall cause the converted and scaled data along with the list and word numbers from G&N 721 to be filed on the command file tape. Whenever the "724 STOP FILING R-START" is depressed, filing shall be suppressed and remain suppressed as long as the R-START is ACTIVE. In the case of events, the flag will cause the 15 bit G&N computer word containing the bit to be filed along with its word and list numbers. Multiple calls for the same word to be filed will be treated as one call.

3. Specified words shall be sent to G&N 722 for processing. Filing and processing requirements for these words shall be defined in G&N 722.

4. Multiple displays - Certain G&N computer words will be processed in more than one manner. Multiple card sets will define these displays (i.e. one set displaying a word in octal and additional card sets displaying various bits of the same word as events, ANDed and ORed events).

5. All G&N subprogram errors shall be "ORed" for a single event display in addition to their individual displays. The reset of this display shall be the same as the reset of the individual error displays.

Title: Uplink Transmission Program G&N 731

Part Of: Uplink Program

Purpose: This subprogram checks the received keycode inputs for parity and valid codes and then formats them into a command word for transmission to the External DTCS. The status of the Uplink system and the G&N Computer is monitored, and the Uplink command sequence is controlled to the acceptable input rate of the G&N Computer.

Calling Sequence:

Entry: This subprogram operates under Uplink Executive Program control and may be initiated via K-START, G&N Subprograms or special purpose parametric input routines ("ADAP").

Data:

Input:

1) The data content utilized by this subprogram consists of a five bit Keycode plus a parity bit (odd parity). The input consists of information received from K-START punched tape (Automatic Mode) or from the K-START Keyboard (Manual Mode), from G&N Subprogram or from a special purpose parametric input routine (ADAP).

2) Keycode delay factor of XXX milliseconds entered via C-START.

3) Options entered via R-STARTS as defined in the PRPS/PRD. These options are:

    a) Verify or Load-Verify

    b) Block Uplink Override

Output: Output will consist of a sequence of formated data words, which is transmitted to the G&N buffer, the time delay factor display and error displays.

Normal Exit: Return to Uplink Executive Program.

Error Exit: Error conditions will be displayed for the operator and recorded on the Uplink File Command Tape. These error conditions are subsequently described in Table 731-2.

Computation Sequence: This subprogram shall initialized by a Keycode entry from any of the following:

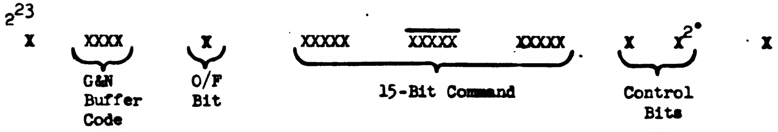
Computation Sequence (cont'd)

1. Operator action by means of the K-START module, either in manual or automatic modes.
2. Upon entry from a G&N Subprogram.
3. Upon entry from a special purpose parametric input routine (ADAP).

This subprogram shall then perform the following:

1. Check for the K-START module VERIFY & LOAD VERIFY XEQ upon entry of a keycode into this subprogram. If this XEQ is detected transfer control to G&N 732. If this XEQ is not detected proceed.
2. Check the received Keycode with the parity bit to assure that odd parity exists. If this parity check fails terminate entry and/or generate NON-VERIFY on K-START module depending on source of entry. Inhibit the transmission of the Keycode and display and record the error condition as specified in Table 731-2.
3. Check the validity of the received keycode. The valid keycodes are listed in Table 731-1. If the keycode is not valid terminate entry and/or generate a NON-VERIFY on the K-START, inhibit the transmission of the keycode and display and record the error condition as specified in Table 731-2.
4. Transform the valid keycode into a 16-bit word and combine it with the DTCS G&N buffer address and required control bits as indicated in Figure 731-1.

G&N UPLINK WORD FORMAT



- FIGURE 731-1 -

Computation Sequence: (continued)

5. Check the Block Uplink discrete and if ON, check the R-START "Block Uplink Override". If Block Uplink is ON and "Block Uplink Override" is OFF, terminate entry and generate a "NON-VERIFY" on the K-START, inhibit the transmission of the keycode and record the error condition as specified in Table 731-2. If Block Uplink is ON and Block Uplink Override is ON, inhibit the "NON-VERIFY" and allow further tests on the keycode. Each keycode transmitted to the G&N computer when Block Uplink is ON and Block Uplink Override is ON shall be recorded on the Uplink File Tape as normal along with the Block Uplink Overriden message.

6. Check for V36 in a Command sequence. If present, two GC discretes are monitored, namely "Gimbal Lock" and "IMU Operate". If both discretes are set to an "ON" state and the keycode is an "ENTER", a "Non-Verify" display will occur on the K-START, the "ENTER" keycode will not be transmitted.Uplink and the error condition will be recorded as specified in Table 731-2. The inhibiting of the "ENTER" keycode will remain in effect as long as the "Gimbal Lock" and "IMU Operate" discretes are "ON" or until a "VERB" keycode is transmitted.

7. Check the Operator Error discrete. If this discrete is ON and the Keycode is a Reset Keycode, transmit the Reset Keycode after the proper delay. If the Operator Error discrete is ON and the Keycode is not a Reset Keycode terminate entry and generate a "NON-VERIFY" on the K-START, inhibit the transmission of the Keycode and record the error condition as specified in Table 731-2. The Operator Error discrete shall be cleared upon entry of a Reset Keycode by the operator after the "NON-VERIFY" switch is reset. This allows the operator to continue sending the interrupted sequence of commands by re-inserting the previous Keycode.

8. Check the UPLOCK discrete. If this discrete is ON and the Keycode is a Reset Keycode, zero the G&N Computer Uplink register and transmit the Reset Keycode after the proper delay. If the Uplock discrete is ON and the Keycode is not a Reset Keycode terminate entry and generate a "NON-VERIFY" on the K-START, inhibit the transmission of the K-START, inhibit the transmission of the keycode and record the error condition as specified

8. (continued)
in Table 731-2. The UPLOCK discrete shall be cleared upon entry of a Reset Keycode by the Operator after the "NON-VERIFY" switch is reset. This allows theoperator to continue sending the interrupted sequence of commands by re-inserting the previous Keycode.

9. Check the CSR message from the DTCS after the transmission of every keycode. If the CSB is "good", unseal the entry after the specified time delay. (The time delay is utilized to control the input rate of the Keycode to the G&N Computer and shall nominally be 90 milliseconds unless modified by C-START.) If the CSR is "bad" terminate entry and generate a "NON-VERIFY" on the K-START and unseal the entry to allow further operator action.

10. Check for the R-START module Verify, Load Verify XEQ. If this XEQ is detected transfer control to G&N 732.

11. Generate a verify on the K-START and/or return to the Uplink Executive depending upon source of entry.

12. Display the following:

    a. The time delay factor in XXX milliseconds and the appropriate nomenclature.

    b. Program error displays as specified in Table 731-2.

Operator Action:

Console Operator: See "Computation Sequence".

Uplink Requirements:

DTCS Transmission: The data word transmitted to the G&N buffer is identified in the Computation Sequence and will be generated as required.

Filing:

1) All K-START command information will be recorded on the command tape.

2) Additional recordings for error conditions and discrete inhibits are specified in Table 731-2.

3) Each G&N Computer Uplink word transmitted while Block Uplink is ON will be filed on the Uplink File Tape along with the Block Uplink Overridden Message.

- TABLE 731-1 -

LEGAL G&N COMPUTER KEYCODES

Character	Code
	MSB LSB
0	10000
1	00001
2	00010
3	00011
4	00100
5	00101
6	00110
7	00111
8	01000
9	01001
VERB	10001
RESET	10010
KEY RELEASE	11001
PLUS	11010
MINUS	11011
ENTER	11100
CLEAR	11110
NOUN	11111

- TABLE 731-2 -

ERROR DISPLAY DEFINITIONS

Error or Discrete	Display	K-START Module Display	Command Tape Edit
Odd parity does not exist in the data frame received.	PARERR 1	Non-Verify	731, PARERR 1, Time Ref.
An invalid G&N Computer keycode has been received by this subprogram.	KEYERR 1	Non-Verify	731, KEYERR 1, Time Ref.
An illegal entry of a V36E has occurred.	KEYERR 2	Non-Verify	731, KEYERR 2, Time Ref.
This indicates that an incorrect keycode loading procedure has occurred and that further entry is inhibited.	OPERATOR ERROR ON*	Non-Verify	731, Op. Error, Time Ref.
This indicates that a previous keycode was not transmitted correctly and that the present keycode is not a reset keycode.	UPLOCK ON* OR K-$\bar{K}$-K FAIL ON*	Non-Verify	731, FORMERR, Time Ref.
No keycodes can be received by the G&N Computer via Uplink, therefore further keycode entry is inhibited.	BLOCK UPLINK ON*	Non-Verify**	731, Block Uplink ON, Time Ref.
R-Start Block Uplink Override ON and Block Uplink ON.			Block Uplink Overridden
Bad CSR	CSR NG	Non-Verify	None

* These displays are set by the Guidance Computer Downlink Format and Interpretation Program G&N 721.

** A Verify display will occur if the R-START "Block Uplink Override" has been executed.

Title: Uplink Transmission Program G&N 731A.

Part Of: Uplink Program

Purpose: This subprogram controls the transmission of all Uplink commands from the ACE-S/C Station to the G&N Computer. These commands may come from any source such as K-START punched tape, K-START keyboard, from other G&N Subprograms or ADAP routines. The subprogram checks the received keycode inputs for parity and valid codes and then formats them into a command word for transmission to the External DTCS. The status of the Uplink system and the G&N Computer is monitored, and the Uplink command sequence is controlled to the acceptable input rate of the G&N Computer.

Calling Sequence: Entry: This subprogram operates under Uplink Executive Program control and may be initiated via K-START, G&N Subprograms or special purpose parametric input routines ('ADAP').

Data: Input:

1) The data content utilized by this subprogram consists of a five bit Keycode plus a parity bit (odd parity). The input consists of information received from K-START punched tape (Automatic Mode), from the K-START Keyboard (Manual Mode), from other G&N Subprograms or from a special purpose parametric input routine (ADAP).

2) Keycode delay factor of XXX milliseconds entered via C-START. An entry of 000 milliseconds will not be a valid time delay.

3) Options entered via R-STARTS as defined in the PRPS/PRD. These options are:

   a) Verify, Load-Verify or DCA Verify

   b) Block Uplink Override

Output: Output will consist of a sequence of formated data words, which is transmitted to the G&N buffer, the time delay factor display and error displays.

Normal Exit: Return to Uplink Executive Program.

Error Exit: Error conditions will be displayed for the operator and recorded on the Uplink File Command Tape. These error conditions are subsequently described in Table 731-2.

Computation Sequence: This subprogram shall be initialized by a Keycode entry from any of the following:

Computation Sequence: (continued)

1. Operator action by means of the K-START module, either in manual or automatic modes.

2. Upon entry from a G&N Subprogram.

3. Upon entry from a special purpose parametric input routine (ADAP).

This subprogram shall then perform the following:

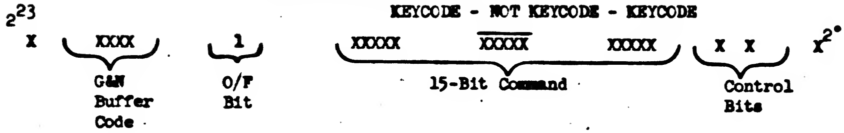
1. Check for the R-START module VERIFY, LOAD-VERIFY or DCA VERIFY XEQ upon entry of a keycode into this subprogram. If this XEQ is detected transfer control to G&N 732. If this XEQ is not detected proceed.

2. Check the received Keycode with the parity bit to assure that odd parity exists. If this parity check fails terminate entry and/or generate NON-VERIFY on K-START module depending on source of entry. Inhibit the transmission of the Keycode and display and record the error condition as specified in Table 731-2.

3. Check the validity of the received keycode. The valid keycodes are listed in Table 731-1. If the keycode is not valid terminate entry and/or generate a NON-VERIFY on the K-START, inhibit the transmission of the keycode and display and record the error condition as specified in Table 731-2.

4. Transform the valid keycode into a 16-bit word and combine it with the DTCS G&N buffer address and required control bits as indicated in Figure 731-1.

G&N UPLINK WORD FORMAT



- FIGURE 731-1 -

Computation Sequence: (Continued)

5. Check the Block Uplink discrete and if ON, check the R-START "Block Uplink Override." If Block Uplink is ON and "Block Uplink Override" is OFF, terminate entry and generate a "NON-VERIFY" on the K-START, inhibit the transmission of the keycode and record the error condition as specified in Table 731-2. If Block Uplink is On and Block Uplink Override is ON, inhibit the "NON-VERIFY" and allow further tests on the keycode. Each keycode transmitted to the G&N Computer when Block Uplink is ON and Block Uplink Override is ON shall be recorded on the Uplink File Tape as normal along with the Block Uplink Overridden message.

6. Check for V36 in a command sequence. If present, two GC discretes are monitored, namely "Gimbal Lock" and "IMU Operate". If both discretes are set to an "ON" state and the keycode is an "ENTER", a "Non-Verify" display will occur on the K-START, the "ENTER" keycode will not be transmitted Uplink and the error condition will be recorded as specified in Table 731-2. The inhibiting of the "ENTER" keycode will remain in effect as long as the "Gimbql Lock" and "IMU Operate" discretes are "ON" or until a "VERB" keycode is transmitted.

7. Check the Operator Error discrete. If this discrete is ON and the Keycode is a Reset Keycode, transmit the Reset Keycode after the proper delay. If the Operator Error discrete is ON and the Keycode is not a Reset Keycode terminate entry and generate a "NON-VERIFY" on the K-START, inhibit the transmission of the Keycode and record the error condition as specified in Table 731-2. The Operator Error discrete shall be cleared upon entry of a Reset Keycode by the operator after the "NON-VERIFY" switch is reset. This allows the operator to continue sending the interrupted sequence of commands by re-inserting the previous Keycode.

Computation Sequence: (Continued)

8. Check the UPLOCK discrete. If this discrete is ON and the Keycode is a Reset Keycode, zero the G&N Computer Uplink register and transmit the Reset Keycode after the proper delay. If the Uplock discrete is ON and the Keycode is not a Reset Keycode terminate entry and generate a "NON-VERIFY" on the K-START, inhibit the transmission of the K-START, inhibit the transmission of the keycode and record the error condition as specified in Table 731-2. The UPLOCK discrete shall be cleared upon entry of a Reset Keycode by the Operator after the "NON-VERIFY" switch is reset. This allows the operator to continue sending the interrupted sequence of commands by re-inserting the previous Keycode.

9. Check the DCA Verify Option in G&N 732. If the DCA Verify Option is activated, the Keycode shall not be transmitted.

10. Check the CSR message from the DTCS after the transmission of every keycode. If the CSR is "good", unseal the entry after the specified time delay. (The time delay is utilized to control the input rate of the Keycodes to the G&N Computer and shall nominally be 90 milliseconds unless modified by C-START.). If the CSR is "bad" terminate entry and generate a "NON-VERIFY" on the K-START and unseal the entry to allow further operator action.

11. Check for the R-START module Verify, Load Verify or DCA Verify XEQ. If this XEQ is detected transfer control to G&N 732.

12. Generate a verify on the K-START and/or return to the Uplink Executive depending upon source of entry.

13. Display the following:

    a. The time delay factor in XXX milliseconds and the appropriate nomenclature.

    b. Program error displays as specified in Table 731-2.

Operator Action: Console Operator: See "Computation Sequence".

Uplink Requirements:

DTCS Transmission: The data word transmitted to the G&N buffer is identified in the Computation Sequence and will be generated as required. The Keycode shall not be transmitted if the DCA Verify Option of G&N 732 is activated.

Filing:

1) All K-START command information will be recorded on the command tape even if it is not transmitted.

2) Additional recordings for error conditions and discrete inhibits are specified in Table 731-2.

3) Each G&N Computer Uplink word transmitted while Block Uplink is ON will be filed on the Uplink File Tape along with the Block Uplink Overridden message.

- TABLE 731-1 -

LEGAL G&N COMPUTER KEYCODES

Character	Code MSB LSB
0	10000
1	00001
2	00010
3	00011
4	00100
5	00101
6	00110
7	00111
8	01000
9	01001
VERB	10001
RESET	10010
KEY RELEASE	11001
PLUS	11010
MINUS	11011
ENTER	11100
CLEAR	11110
NOUN	11111

- TABLE 731-2 -

ERROR DISPLAY DEFINITION

Error or Discrete	Display	K-START Module Display	Command Tape Edit
Odd parity does not exist in the data frame received.	PARERR 1	Non-Verify	731, PARERR 1, Time Ref.
An invalid G&N Computer keycode has been received by this subprogram.	KEYERR 1	Non-Verify	731, KEYERR 1, Time Ref.
An illegal entry of a V36E has occurred.	KEYERR 2	Non-Verify	731, KEYERR 2, Time Ref.
This indicates that an incorrect keycode loading procedure has occurred and that further entry is inhibited.	OPERATOR ERROR ON*	Non-Verify	731, Op. Error, Time Ref.
This indicates that a previous keycode was not transmitted correctly and that the present keycode is not a reset keycode.	UPLOCK ON* OR K-K̄-K FAIL ON*	Non-Verify	731, FORMERR, Time Ref.
No keycodes can be received by the G&N Computer via Uplink, therefore further keycode entry is inhibited.	BLOCK UPLINK ON*	Non-Verify**	731, Block Uplink ON, Time Ref.
R-START Block Uplink Override ON and Block Uplink ON.			Block Uplink Overridden
Bad CSR	CSR NG	Non-Verify	None

* These displays are set by the Guidance Computer Downlink Format and Interpretation Program G&N 721.

** A Verify display will occur if the R-START "Block Uplink Override" has been executed.

Title: Special K-Start Load-Verify and Verify Program G&N 732

Part Of: Uplink Program

Purpose: This program is used to load and verify the contents of the G&N computer erasable memory locations. All data to be verified is specified on prepunched K-Start input tapes.

Three options have been provided for data verification. Selection of these options is attained through activation of R-Start Module function switches and K-Start.

Calling Sequence: Entry: This program is activated only by the K-Start Module Program (G&N 731), whenever it in turn has been activated and also if the R-Start Module specified in the PRPS or PRD has been executed. Function switches of this R-Start Module specify one of three options used by G&N 732. These are:

1. Load-Verify - Activation of the specified R-Start Module function switch causes G&N 732 to verify that the data being loaded into erasable G&N computer memory locations is identical to the data stored on the K-Start input tape.
2. Verify - Activation of the specified R-Start Module function switch causes G&N 732 to check and verify that the contents of previously loaded and verified G&N computer erasable memory locations have not been altered by internal G&N computer functions or external input means.
3. DCA Verify - Activation of the specified R-Start causes G&N 732 to compare a K-Start tape to the contents of R1 and R3 of the DSKY display.

Data: This consists of information received from punched K-Start tapes. The data content utilized by this subprogram consists of five bit keycodes plus a parity level.

Normal Exit:

1. Return to G&N 731 whenever keycodes are to be checked for validity and parity and/or transmitted to the G&N computer.
2. Return to Uplink Executive Program when a complete special K-Start tape sequence has been processed by G&N 732 and 731.

Error Exit: Error conditions will be displayed and recorded for operation action.

Computation Sequence:

Activation of this program is attained via the K-Start Module Program, G&N 731 following operator action on the specified R-Start Module and K-Start Module. Execution of the R-Start must occur before K-Start action. The K-Start execute causes the ACE Executive to activate G&N 731 which in turn activates and maintains close interface with G&N 732, provided R-Start Module execution is sensed by G&N 731. If G&N 731 does not detect execution of this R-Start it then treats the K-Start input tape in a normal fashion.

Upon entry from G&N 731 various counters and indicators are set to specific values depending on which function switch of the R-Start Module has been executed. G&N 732 then reads 18 keycode characters and seals the K-Start Module. These keycode characters represent the initial VERB-NOUN sequence to be verified.

The format of this "record" is checked for validity. There should be 18 keycode characters as defined in Table 732-1. Format non-verification results in an error display, file recording, K-Start Module release and program control return to ACE Executive. If the Verify option has been selected, the one component load Verb-Noun is changed to one component display Verb-Noun (V21N01 to V01N01).

As the keycodes are read from the tape the program shall extract the address and data portions and display each of them as defined in the PRD or PRPS.

Load-Verify and Verify:

For the Load-Verify or the Verify option K keycodes are transmitted uplink. The codes are loaded one at a time into KEY-WORD and 731 is allowed to perform its normal function of completely verifying each keycode from G&N 732 and transmitting each Uplink. (See G&N 731). After all appropriate keycodes have been transmitted Uplink, the Flash discrete is obtained.

A test is made on the Flash discrete. If "ON" (flashing), G&N 732 delays until the next DSPTAB table is displayed by G&N 722 (one second) and repeats the "Flash" test. A third failure in this area will cause an error exit with an error display and a return to ACE Executive.

If the "Flash" discrete is "OFF" (stop flashing), the program delays two seconds and obtains the R1, R3, VERB and NOUN values. This delay is to assure G&N 732 that all pertinent G&N computer DSPTAB updated data has been received by the Display Program. Following this delay the Verb-Noun combination for the particular tape option in progress is checked for validity, the input-address is compared against the contents of R3 and the input constant is compared against the contents of R1. Any invalid test results in an error exit as specified above.

NOTE: The address contained in R3 is four octal digits and may be either right or left justified in the five place register. The least significant position should be checked and if blank the data should be shifted right one place. The data that may be contained in the most significant position, after shifting, should be truncated. The compare is then made on the four least significant positions.

Following valid testing, G&N 732 releases the K-Start seal, reads one keycode character and checks this code for Key-release. Detection of the Key-release code will result in K-Start module seal and an exit to G&N 731 for Uplink transmission of the Key-release Keycode. When re-entered from G&N 731, the K-Start module is un-sealed, KSEQ "OK" is displayed and G&N 732 returns control to the ACE Executive. If, however, the first code of the "record" is not Key-release, G&N 732 reads 11 additional keycode characters and seals the K-Start Module. These keycode characters represent interim "records" of keycode data necessary for the proper operation of the one parameter Load or Display Verb-Noun combination in the G&N computer. The format of each "record" is tested for validity. An improper format results in an error exit as previously specified. With a legal "record" the program sets up a loop, based on the K-value, for Uplink Keycode transmission via G&N 731.

Following successful Keycode transmission G&N 732 obtains pertinent data from the G&N 722 buffer and repeats a sequence of testing as specified above.

DCA Verify:

The DCA verify option functions approximately as the Load and Verify option. The K-Start tape is the same format as the Load and Verify tape and the same validity checks should be made. The keycodes are filed on the command file tape but are not transmitted uplink. The "Flash" discrete and the Verb-Noun comparison checks are not required.

After the K-Start tape address data set is read, checked for validity and displayed the program shall begin checking for a matching address from Register 3 of the DSPTAB's. This check shall be made for each set of DSPTAB's processed by 722. The right or left justify test shall be made on each R3 address check. This check will continue until a match is found or the operator terminates the procedure with a C-Start entry of 3100000000 on C-156. If the sequence is terminated by the operator the program shall display a VERROR 4. The operator then has the three options described under "VERROR Recovery Procedures" available to him.

When an address match is obtained the program will check the data field (Register 1 of the DSPTAB's). If this field compares to the data from the K-Start tape the program will continue with the K-Start tape until all addresses have been verified. If the data field does not compare the program waits until the next set of DSPTAB's are processed by 722 and checks the address field again. If this does not match a VERROR 5 condition exists. If the address does compare the data is checked again. A good compare results in the continuing of the test; a non-compare causes another wait. This loop will be executed up to five times and if the data still does not match a VERROR 5 is indicated.

The DCA Verify option processes successive sets of data until either the test is terminated or completed.

The option is completed by a Key-release from the K-Start which is recorded **on the command file tape but not transmitted Uplink.**

Operator Action:

Console Operator: To activate G&N 732, the R-Start Module specified in the PRPS or PRD must be executed. Three options are available.

1. One function switch selects the Load-Verify option.
2. The second selects the Verify option.
3. The other selects the DCA verify option.

In addition to the R-Start execute, the K-Start Module must also be activated.

The operator's responsibility also includes the monitoring of displays and the initiation of procedures based upon the display interpretation. Before initiating action to process a special K-Start tape via G&N 732, the console operator should check and perform the following operations:

1. Depress the NON-VERIFY switch if the non-verify light is on.

2. Check the status of:

   Operator Error discrete for "ON"
   Block Uplink discrete for "ON"
   Uplock discrete for "ON"

If any of these conditions exist, Uplink transmission will be inhibited by G&N 731. Recovery Procedures for these conditions are specified in the "K-Start Module Program G&N 731" Computation sequence section.

After verifying that the above conditions have been fulfilled the operator may initiate processing of the Special K-Start tape as prescribed. Monitoring should continue during G&N 732 K-Start tape processing. Illumination of the NON-VERIFY light will result in the discontinuation of the Special K-Start tape processing. When this occurs, the console operator should record the indicated error in order to initiate corrective procedures. The error displayed will be one of the following:

1. VERROR 1 through VERROR 5 indicates error detection in G&N 732 (See Table 732-2 for definitions.)

2. PARERR 1, KEYERR 1, Operator Error "ON", Block Uplink "ON", or Uplock "ON" indicates error detection in G&N 731.

An error free K-Start tape sequence will result in the display of KSLQ 'OK'.

VERROR Recovery Procedures

One of three operator actions must be taken if G&N 732 detects an error (VERROR type).

1. Re-cycle: This allows a re-run of the present K-Start tape sequence.
   a. Re-load K-Start tape to Verb character.
   b. Re-initiate K-Start action.

2. Continue: This allows tape operation to continue from point of error.
   a. Re-initiate K-Start action.

3. Abort: This terminates processing of the present K-Start tape sequence.
   a. Manually insert 'ERROR-RESET' to allow G&N 732 to "unseal" the R-Start module.

Spacecraft Operator: No activity required.

Uplink Requirements:

DTCS Transmission: The word transmitted Uplink is identified in the Computation Sequence section of G&N 731 and shall have the time delay routine control specified in G&N 731.

DTCS Stimuli: None

Transmission Time: As required.

Filing: All K-Start command information will be recorded on the command file tape by G&N 731. An additional message will be filed, at the beginning of each block of data, containing R-START function bits in Octal and Block Count in Octal.

All VERROR conditions shall be filed. The error number, BLKCNT and WDCNT will be recorded on the file tape.

Downlink Requirements:

Downlink Display: This information consists of KSEQ 'OK' if no errors occur, or program error displays if any are detected by either G&N 732 or G&N 731. If this test is aborted by means of the 'ERROR-RESET' code, KSEQ'NG' will be displayed. Error displays are defined in Table 732-2. The ACE Requirements Specification contains the CRT scope page and line and event light information.

Remarks: A definition of terms used in this subprogram is as follows:

1. K — Counter which specifies the number of keycodes to be transmitted to the G&N computer.

	Load and Verify	DCA Verify	Verify
K (Initial Transmission	18	0	12
K (Subsequent Transmissions)	12	0	6

2. KEYWORD — Register containing 8 bit keycode for G&N 731 processing.

3. VERROR — Indicator set by G&N 732 whenever errors are encountered.

4. KSEQ — Indicator set to display 'OK' if a complete Verb-Noun sequence is verified error free. Set to 'NG' if test is aborted due to error detection. Entry to G&N 732 blanks 'NG' or 'OK'.

5. BLKCNT — Value specifies K-Start data block being processed when G&N 732 detects an error. Part of Uplink command tape recording.

6. WDCNT	Value specifies last tape input character which was detected as an error by G&N 732. This word count is used in conjunction with the Block Count value. Part of Uplink command tape recording.

Table 732-1

TAPE FORMATS

**Load-Verify, Verify and [illegible]
DCA Tape**

HEADER	
Verb 21 Noun 01	ENTER
4 octal digit address	ENTER
5 octal digit constant	ENTER
	ENTER
4 octal digit address	ENTER
5 octal digit constant	ENTER
⋮	
	ENTER
4 octal digit address	ENTER
5 octal digit constant	ENTER
KEYRELEASE STOP	

Table 732- 2

ERROR DISPLAY DEFINITION FOR G&N 732

Error	Display	K-Start Module Display
Improperly formatted K-Start tape.	VERROR 1	Non-Verify
Flash discrete 'ON'. Load or display Verb-Noun address and/or data values not accepted by GC.	VERROR 2 *	Non-Verify
DSPTAB Verb-Noun not same as input Verb-Noun.	VERROR 3 *	Non-Verify
DSPTAB address (R3) does not verify with input address.	VERROR 4	Non-Verify
DSPTAB constant (R1) does not verify with input constant.	VERROR 5	Non-Verify

* Not generated from DCA tape

Title: G&N High Rate Channel Control Program G&N 741.

Part Of: Communication Program

Purpose: This program controls the switching of selected signals for transmission over the 400 sample/second high rate sampling channel.

Calling Sequence:

Entry: This program will operate under Executive Control and will be initiated from the C-START module specified in the PRPS or PRD.

Data: C-START Module data entry - Window ten (10), eight (8) and seven (7) are set to desired characters.

Normal Exit: Return to Executive Control.

Error Exit: None required.

Computation Sequence: This program is entered from the Exeuctive Program when requested by the C-START module. Selector switches eight (8) and seven (7), are utilized for high rate channel selection, while selector switch ten (10) (leftmost selector switch) will be utilized for program identification. Selector switch ten (10) will be tested, and when found to contain the digit two (2), will cause entry into the high rate channel select program. Selector switches eight (8) and seven (7) will be tested to determine which measurement, if any, is being requested. If the code contained in windows eight (8) and seven (7) is not defined in the Uplink parameter cards of the PRD or PRPS an invalid data entry shall be indicated and the program exits to Executive Control. If the code contained in windows eight (8) and seven (7) is a code for a valid measurement, the program will then cause the computer to generate the commands necessary to energize one or more of the ten high rate control relays in the DTCS, causing the signal to be switched onto the 400 S/S channel. The relay assignments will be specified in GAEC or NA. Program Requirements Specification.

Operator Action:	Console Operator action is required to initiate this program by C-START selection of the high rate signals. The sequence is as follows:

a. The desired program identification digit (2) is entered into selector switch ten (10).

b. The desired measurement identification digits are entered into selector switches eight (8) and seven (7).

c. The XEQ/SEAL Switch is depressed.

Spacecraft Operator: No activity required.

Uplink Requirements:

GC Transmission: None

Time of Transmission: Not defined

Filing Requirements: Measurement ID, time tag

Downlink Requirements:

Measurement ID: The Measurement ID and description is contained in the PRPS or PRD. NOTE: The measurement description is NOT displayed on CRT.

CRT Display: The CRT display is defined in the Uplink parameter cards of the PRD or PRPS.

Filing Requirements: The C-START request shall be filed on the command file tape.

Remarks:

The high rate measurements are sampled 400 samples per second, spaced symmetrically in the telemetry format, by the analog gates in the PCM carry-on system. The time duration over which the measurement is recorded on the analog recorder is determined by the operator.

The required high rate channel information for any given vehicle will be defined by AC in the Programming Requirements issued in a GAEC or NAA process specification.

Title:	ACE-S/C Error Reset Program G&N 771.
Part Of:	Downlink Program
Purpose:	This subprogram resets the error displays on the CRT display unit to give a "no error" indication for the ACE-S/C subprograms utilized with the Block II G&N System.
Calling Sequence:	Entry: This subprogram operates under executive control and is initiated from the R-START Module specified in the PRPS or PRD. Exit: Return to Downlink Executive Program after error displays are reset.
Computation Sequence:	The error displays reset by this subprogram are specified in the PRD or PRPS as category GE and GTER. The CRT page and line location for each error display is detailed in the Program Requirements Process Specification. Each error display consists of a variable segment which signifies the type of error condition occurring in a particular ACE-S/C subprogram, and a fixed title segment. When initiated by the operator, this subprogram will blank out the variable segments of the error displays. This program shall have the option to automatically reset the error displays. This option will be initiated by R-START call as specified in the PRPS or PRD. The program will detect the generation of an error and approximately three seconds later, reset all errors. If another error is generated during the three seconds, the time delay is restarted. At any time the operator may manually reset the errors.
Operator Action:	Console Operator: Operator action is required to initiate this subprogram via the R-START module. Spacecraft Operator: No activity required.
Uplink Requirements;	The ACE-S/C Uplink system is not utilized.
Downlink Requirements:	PCM data processing is not required by this subprogram.

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ACE-S/C COMPUTER SUBPROGRAM
SPECIFICATIONS FOR APOLLO
CM AND LM G & N TESTING

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
				AC	NASA
Ⓜ 7/27/67	H	34236	3, 268, 335, 336, 347, 351,	EA	---
			354, 355, 356, 358, Was 392		
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Ⓜ 8/31/67	J	34461	3, 317, 319, 328, 331, 342, 381,	EA	---
			382 ROG/AC		
Ⓜ 9/14/67	K	34608	378, 379	EA	--
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Ⓜ 2/1/68	M	35548	3, 235-398; was 398 pages, now	EA	--
			432 pages.		
3/22/68	N	35927	406, now 433 pages.	EA	WLS

This specification consists of page 1 to 432 inclusive.

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D. (continued)

3. The 15 bits are converted to decimal either signed or unsigned for which two scale factors apply. The scale factor to be used is determined by an event.

4. Offset Data - Two scale factors are involved. Two card sets shall be required with one card set containing the octal value (5 digits) which represents the zero condition, and the other card set containing the normal scale factor. The G&N Computer word is to be treated as an unsigned 15 bit word. The offset data is to be processed by one of the following two methods:

   a. If the G&N Computer word is greater than or equal to the offset value (zero condition), subtract the offset value from the G&N Computer word, convert to decimal and multiply by the normal scale factor. If the G&N Computer word is less than the offset value, add the 2's complement of the offset value to the G&N Computer word, convert to decimal and multiply by the normal scale factor.

   b. Subtract the offset value (zero condition) from the G&N Computer word, convert to decimal and multiply by the normal scale factor.

E. Double Precision Conversion (i.e. 30 bits treated as a single word).

1. A double precision word is converted to decimal and multiplied by a specified scale factor.

2. A double precision word is converted to decimal for which two scale factors apply. The scale factor to be used is determined by an event.

3. A double precision word is converted to hours, minutes and seconds with the value of the LSB equal to 10 milliseconds. The display shall be XX HRS XX MIN XX.XX SEC. The time for G&N 701 (Uplink) shall be identified.

4. Since the sign of the LSB may not necessarily agree with the sign of the MSB, the following equation is given as a representative method of converting:

$$\left[+16384 * (\text{MSB})_{10} + (\text{LSB})_{10}\right] * \text{Scale}$$

Factor = Double Precision Answer where the sign of both the LSB and MSB must be used.

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ACE-S/C COMPUTER SUBPROGRAM
SPECIFICATIONS FOR APOLLO
CM AND LM G & N TESTING

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9/14/67	K	34608	378, 379	EA	--
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210	G&N Downlink Edit Program	4-210.1
221A	AGC Downlink Format Program Block 2	4-221A.1
224A	CGC Downlink Interpretation Program, Block II	4-224A.1
601	Guidance Computer Clock Initialization Program	4-601.1
602	Guidance Computer Time Verification Program	4-602.1
603	Guidance Computer Time Correction Program	4-603.1
621	Guidance Computer Downlink Format Program	4-621.1
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622A	Guidance Computer Display Program	4-622A.1
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624A	LEM Downlink Interpretation Program	4-624A.1
624B	LGC Downlink Interpretation Program	4-624B.1
624-200	LGC Downlink Interpretation Program	4-624-200.1
631	Guidance Computer Uplink Verification Program	4-631.1
632	Special K-Start Load-Verify, Verify, and Dump Program	4-632.1
641	G&N High Rate Channel Control Program	4-641.1
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701A	G&N Computer Clock Initialization Program	4-701A.1

3. The G&N computer clock may be zeroed by execution of the R-START option A provided the C-START entry 70YYYYY000 has been made. If the R-START is executed without the C-START an error condition is noted by a TIME ERROR 2.
4. The difference between the present G&N computer clock reading and the desired setting can be calculated by execution of R-START option B. If the two C-START entries 90 and 91 have not been made the error is noted by a TIME ERROR 2.

   Uplink shall calculate the ΔT correction by requesting the latest valid G&N computer clock time (T_A) and range time tag (T_{R2}) from downlink. If this is not available the error shall be noted by a TIME ERROR 4. If a valid T_A is received the calculation is as follows:

   $$\Delta T = T_{R2} + D - (T_A + K)$$

   The results of this calculation shall be displayed on the CRT as signed hours, minutes, seconds and centiseconds. At the time the calculation is made the following information shall be recorded on the command file tape:
   a. ΔT
   b. T_{R2}
   c. $(T_A + K)$
   d. D
5. The operator has the option of correcting the G&N computer clock by the amount ΔT if he executes R-START option C. If option C is executed without executing option B the error condition shall be noted by a TIME ERROR 2.

   The program shall zero the G&N computer clock with the following series of commands if option A is executed:

   VERB
   2
   4
   NOUN
   0
   1
   ENTER
   Digit 1 octal address
   Digit 2 octal address

3. Check that the number of words received is not greater than the list length. If so, display SYNCERR 1 and file SYNCERR 1 as defined in Table 721-1 and wait until a valid ID word is received.

4. For a WOC = 0, perform ID check for:

   a. Correct fixed bit sync word of 77340_8 in bits 1-15 of 2nd word in block.

   b. Correct fixed bit sync word of 00437_8 in bits 1-15 of 2nd word in block.

   c. Correct data list address in bits 1-15 of 1st word in block.

5. If steps 4a and 4c or 4b and 4c above are correct, set an indicator to specify the type of fixed bit sync word to be processed and proceed with step 6. If incorrect proceed with step 7.

6. Check that a valid ID word has not been received too soon. If it has, display and file SYNCERR 2 as defined in Table 721-1 and proceed as if it had been received in the correct sequence. Proceed with step 9.

7. If steps 4a and 4c or 4b and 4c above fail, check to see if this should be a block 51 with a WOC = 0. If not, display and file WORDERR 2 as defined in Table 721-1 and return to step 1 above. If this is block 51 data, proceed with step 9, otherwise assume this is block 51 data, display a WORDERR 3 and file this data. Proceed with step 9.

8. For a WOC ≠ 0, check if this should be block 51 data with a WOC = 0. If so display and file SYNCERR 1 as specified in Table 721-1 and return to step 1 above.

9. DSPTAB words +0 through +10D are to be sent to G&N 722 along with the identifier after taking the ones complement of the DSPTAB word if bit 15 is a one (1). All other words are to be processed per the Downlink Requirements Cards.

10. When G&N Computer power is off, all bits in the T/M word blocks will be zero or when the G&N Computer is in Standby, all bits will be ones causing a constant WORDERR 1. When this condition exists, three successive WORDERR 1 displays are obtained so return to step 1.

Title: Display Program (DSPTAB) G&N 722A.

Part Of: Downlink Program

Purpose: The Display Program interprets all DSPTAB words that are detected as such by the Downlink Format Program and generates displays identical in content and format to the on-board spacecraft DSKY displays. This program provides ACE-S/C ground station test personnel the capability of continuously monitoring all spacecraft keyboard displays.

Calling Sequence:

Entry: This program is activated only by the Downlink Format Program whenever program display words are to be interpreted.

Data: Input: Inputs to the Display Program shall consist of a complete 16-bit Downlink DSPTAB word and identifier.

Output: Coded information to be displayed.

Normal: Exit: Return to the ACE Executive Program.

Error Exit: Error conditions shall cause error information to be displayed and recorded on the file tape. After error recording, control is returned to the ACE Executive Program. Error messages are detailed in Table 722-3.

Computation Sequence: Activation of the Display Program is attained via the Downlink Format Program. Inputs to this program will be the 16-bit Downlink word and an identifier. The identifier specifies which DSPTAB word in the Downlink list is to be processed.

The 16-bit Downlink DSPTAB word consists of four parts of coded information plus a parity bit. The four parts are:

1. Bits 15-12: The address in these bits is not used.
2. Bit 11: The special code in this bit specifies a particular discrete associated with the DSPTAB word.

Sequence 1 - extracts the relay code corresponding to bits 10-6 of the Downlink word and checks it against Table 722-2 for legality. If the code is legal the indicator is set to display the digit from Table 722-2 followed by a transfer to sequence 2. If the code is not legal clear the sign display indicator and initiate a relay-error exit. (See Table 722-3)

Sequence 2 - extracts the relay code corresponding to bits 5-1 and checks it against Table 722-2 for legality. If the code is legal the indicator is set to display the digit from Table 722-2 followed by a return to the ACE Executive Program. If the code is not legal, clear the sign and first digit display indicators and initiate a relay-error exit. (See Table 722-3)

Filing - After the processing of the eleventh display word and if the CRT display has changed since the last recording, the entire display is to be recorded (including FLASH). The recording should be prefaced by 722 Display Recording.

Option - At the option of the operator, an R-START may be activated to inhibit the filing of the entire display on the file tape.

Operator Action:

Console Operator: The operator shall have the option to inhibit transcribing the entire display on file tape by use of an R-START as explained under "option" of the "Computation sequence".

Downlink Requirements:

Display: Display the results of the "computation sequence" sequence 1 and 2.

Filing: The results of this subprogram shall be filed as explained in the "computation sequence".

Title: G&N Downlink Processing Requirements, G&N 724.

Purpose: This subprogram defines the handling, processing and filing requirements for the G&N Downlink words.

Computation Sequence: The processing requirements for the G&N computer downlink words will be specified on the Downlink Requirements cards in the PRPS or PRD. The following lists the types of processing to be available for G&N computer downlink words:

A. Events

1. Single event display where either a "0" or a "1" (normal or inverted) will be the off state of the event.
2. "ANDed" where two or more normal or inverted events may be "ANDed" for a single display. (i.e. $A \cdot \bar{B} \cdot C$)
3. "ORed" where two or more normal or inverted events may be "ORed" for a single display. (i.e. $A + \bar{B} + \bar{C} + D$)
4. Store value for G&N 722 or 732 and set "Flash" VERB/NOUN if the bit is ON or stop "Flash" if bit is OFF.
5. Store bits for G&N 731 use. (Uplink)

B. Binary Conversion

1. Display the bit specified in binary. (i.e. a "0" or a "1").

C. Octal Conversion

1. The 15 bits are converted to 5 octal digits.

D. Decimal Conversion

1. The 15 bits are considered unsigned, converted to decimal and multiplied by a specified scale factor.
2. The 15 bits are considered signed, converted to decimal and multiplied by a specified scale factor.

D. (continued)

3. The 15 bits are converted to decimal either signed or unsigned for which two scale factors apply. The scale factor to be used is determined by an event.

4. Offset Data - Two scale factors are involved. Two card sets shall be required with one card set containing the octal value (5 digits) which represents the zero condition, and the other card set containing the normal scale factor. The G&N Computer word is to be treated as an unsigned 15 bit word. The offset data is to be processed by one of the following two methods:

    a. If the G&N Computer word is greater than or equal to the offset value (zero condition), subtract the offset value from the G&N Computer word, convert to decimal and multiply by the normal scale factor. If the G&N Computer word is less than the offset value, add the 2's complement of the offset value to the G&N Computer word, convert to decimal and multiply by the normal scale factor.

    b. Subtract the offset value (zero condition) from the G&N Computer word, convert to decimal and multiply by the normal scale factor.

E. Double Precision Conversion (i.e. 30 bits treated as a single word).

1. A double precision word is converted to decimal and multiplied by a specified scale factor.

2. A double precision word is converted to decimal for which two scale factors apply. The scale factor to be used is determined by an event.

3. A double precision word is converted to hours, minutes and seconds with the value of the LSB equal to 10 milliseconds. The display shall be XX HRS XX MIN XX.XX SEC. The time for G&N 701 (Uplink) shall be identified.

4. Since the sign of the LSB may not necessarily agree with the sign of the MSB, the following equation is given as a representative method of converting:

$$\left[+16384 * (\text{MSB})_{10} + (\text{LSB})_{10}\right] * \text{Scale}$$

Factor = Double Precision Answer where the sign of both the LSB and MSB must be used.

Computation Sequence: (Continued)

5. Check the Block Uplink discrete and if ON, check the R-START "Block Uplink Override." If Block Uplink is ON and "Block Uplink Override" is OFF, terminate entry and generate a "NON-VERIFY" on the K-START, inhibit the transmission of the keycode and record the error condition as specified in Table 731-2. If Block Uplink is On and Block Uplink Override is ON, inhibit the "NON-VERIFY" and allow further tests on the keycode. Each keycode transmitted to the G&N Computer when Block Uplink is ON and Block Uplink Override is ON shall be recorded on the Uplink File Tape as normal along with the Block Uplink Overridden message.

6. Check for V36 in a command sequence. If present, two GC discretes are monitored, namely "Gimbal Lock" and "IMU Operate". If both discretes are set to an "ON" state and the keycode is an "ENTER", a "Non-Verify" display will occur on the K-START, the "ENTER" keycode will not be transmitted Uplink and the error condition will be recorded as specified in Table 731-2. The inhibiting of the "ENTER" keycode will remain in effect as long as the "Gimbql Lock" and "IMU Operate" discretes are "ON" or until a "VERB" keycode is transmitted.

7. Check the Operator Error discrete. If this discrete is ON and the Keycode is a Reset Keycode, transmit the Reset Keycode after the proper delay. If the Operator Error discrete is ON and the Keycode is not a Reset Keycode terminate entry and generate a "NON-VERIFY" on the K-START, inhibit the transmission of the Keycode and record the error condition as specified in Table 731-2. The Operator Error discrete shall be cleared upon entry of a Reset Keycode by the operator after the "NON-VERIFY" switch is reset. This allows the operator to continue sending the interrupted sequence of commands by re-inserting the previous Keycode.

APOLLO G&N Specification
ND1002319 REV S
Original Issue Date:
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Class A Release

ACE-S/C COMPUTER SUBPROGRAM
SPECIFICATIONS FOR APOLLO
CM AND LM G & N TESTING

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
				AC	NASA
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			354, 355, 356, 358. Was 392		
			pages; now 398 pages. RDG/AC		
8/31/67	J	34461	3, 317, 319, 328, 331, 342, 381,	EA	---
			382 RDG/AC		
9/14/67	K	34608	378, 379	EA	--
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2/1/68	M	35548	3, 235-398; was 398 pages, now	EA	--
			432 pages.		
3/22/68	N	35927	406, now 433 pages.	EA	WLS
10/30/68	P	36969	3, 382-437; was 432 pages, now 43	EA	WLS
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5/1/69	S	37570	411	EA	RJJ

This specification consists of page 1 to 437 inclusive.

APPROVALS	**NASA/MSC**	**MIT/IL**	**AC**

D. (continued)

3. The 15 bits are converted to decimal either signed or unsigned for which two scale factors apply. The scale factor to be used is determined by an event.

4. Offset Data - Two scale factors are involved. Two card sets shall be required with one card set containing the octal value (5 digits) which represents the zero condition, and the other card set containing the normal scale factor. The G&N Computer word is to be treated as an unsigned 15 bit word. The offset data is to be processed by one of the following two methods:

    a. If the G&N Computer word is greater than or equal to the offset value (zero condition), subtract the offset value from the G&N Computer word, convert to decimal and multiply by the normal scale factor. If the G&N Computer word is less than the offset value, add the 2's complement of the offset value to the G&N Computer word, convert to decimal and multiply by the normal scale factor.

    b. Subtract the offset value (zero condition) from the G&N Computer word, convert to decimal and multiply by the normal scale factor.

E. Double Precision Conversion (i.e. 30 bits treated as a single word).

1. A double precision word is converted to decimal and multiplied by a specified scale factor.

2. A double precision word is converted to decimal for which two or three scale factors apply. The scale factor to be used is determined by an event or events.

3. A double precision word is converted to hours, minutes and seconds with the value of the LSB equal to 10 milliseconds. The display shall be XX HRS XX MIN XX.XX SEC. The time for G&N 701 (Uplink) shall be identified.

4. Since the sign of the LSB may not necessarily agree with the sign of the MSB, the following equation is given as a representative method of converting:

$$\left[+16384 * (\mathrm{MSB})_{10} + (\mathrm{LSB})_{10}\right] * \text{ Scale}$$

Factor = Double Precision Answer where the sign of both the LSB and MSB must be used.

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ACE-S/C COMPUTER SUBPROGRAM
SPECIFICATIONS FOR APOLLO
CM AND LM G & N TESTING

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11/26/69	T	37949	3, 398; was 437 pages, 9A-A2 now 447	EA	MDH

This specification consists of page 1 to 447 inclusive.

APPROVALS	**NASA/MSC**	William Swingle **MIT/IL**		R. Petyrk D. A. Ziemer **ACSP**

APOLLO G&N Specification
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ACE-S/C COMPUTER SUBPROGRAM SPECIFICATIONS FOR APOLLO CM AND LM G & N TESTING

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This specification consists of page 1 to 447 inclusive.

APPROVALS	**NASA/MSC**	William Swingle **MIT/IL**	**R. Petyrk**	**D. A. Ziemer** DE

APOLLO G&N Specification
ND1002321 REV — A
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G&N PROGRAMMING REQUIREMENTS
(DISPLAYS & CONTROLS)
FOR
ACCEPTANCE CHECKOUT EQUIPMENT
(BLOCK II)

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
				AC	NASA
11/1/66	A	31761	3-33 Was 33 pages, now 42 pgs.	WC/EA	WLS

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APPROVALS NASA/MSC AC

3. REQUIREMENTS

3.1 G&N SPACECRAFT SUBPROGRAMS. The subprograms contained in Specification ND1002319 shall be used for the applicable Spacecraft configuration as specified in Table I.

TABLE I
SUBPROGRAMS

SPACECRAFT	SUBPROGRAMS	
	AC ELECTRONICS Identification Number	ASPO Identification Number
2TV1-M 102-N 103-N	G&N 601	MIT-U005-0
	602	U006-0
	603	U007-0
	221	D012-0
	622	D008-0
	224	D013-0
	631	C003-0
	641 (or equiv. ADAP* program)	C004-0
	652	D010-0
	671	D011-0
	G&N 181 (or equiv. ADAP* program)	MIT-U104-0

*Not applicable to S/C 2TV1.

3.2 SIGNAL BLINK LIMITS. The following signal blink limits shall apply to all G&N Spacecraft.

a. The following signals shall have blink limits equal to tolerances specified in the applicable NAA Acceptance Checkout Equipment-SC Programming Requirements process Specification MA0201.

CG 1020
CG 1030
CG 1040
CG 1051
CG 1052
CG 1070
CG 1100
CG 1110
CG 1201
CG 1202
CG 1203
CG 1211
CG 1212
CG 1331
CG 1336
CG 1500
CG 1510
CG 1520
CG 1530

b. The following signals shall have blink limits of ±4095:

CG 1021
CG 1031
CG 1042
CG 1053
CG 1071
CG 1207
CG 1220
CG 1501
CG 1511
CG 1521
CG 1531
CG 2001
CG 2021
CG 2041
CG 2108
CG 2117
CG 2120
CG 2138
CG 2147
CG 2150
CG 2168
CG 2177
CG 2180
CG 2219
CG 2220
CG 2221
CG 2249
CG 2250
CG 2251
CG 2279
CG 2280
CG 2281
CG 2300
CG 2301
CG 3011
CG 3021
CG 3117
CG 3118
CG 3140
CG 3145
CG 3150
CG 3155
CG 3160
CG 3170
CG 3721
CG 3722
CG 4300
CG 6020
CG 6021
CG 9010
CG 9011
CG 9012

3.3 HIGH RATE MEASUREMENTS. The C START Panel shall program the signals specified in Table II, in response to the entry selected on the C START panel, to the channel specified on the GSE Carryon G&N Signal Conditioning and Switching Matrix Unit, C14-213, (SCSMU).

TABLE II

HIGH RATE MEASUREMENTS*

SIGNAL PROGRAMMED MEAS NO.	C-START ENTRY ON C-START PANEL	C14-213 SCSMU CHANNEL NO.
CG 2117	2032000000	01
CG 2120	2027000000	02
CG 2147	2028000000	03
[illegible]	2029000000	04
[illegible]	2030000000	05
CG 2150	2031000000	06
CG 2177	2026000000	07
CG 2180	2005000000	08
CG 2219	2006000000	10
CG 2249	2007000000	11
CG 2279	2009000000	12
CG 3117	2010000000	13
CG 3118	2021000000	14
CG 3140	2025000000	15
[illegible]	2023000000	17
[illegible]	2001000000	18
[illegible]	2002000000	19
[illegible]	2003000000	20
CG 2250	2019000000	22
CG 2220	2020000000	23
CG 3150	2008000000	28
CG 3011	2022000000	29
CG 3021	2024000000	30
CG 3155	2014000000	34
CG 3160	2015000000	35
CG 3170	2016000000	36
CG 2280	2017000000	37
CG 3145	2012000000	40

*Not applicable to S/C 2TV1

3.4 CRT DISPLAYS. The CRT screen on the CRT module shall display information for each Spacecraft in accordance with Table III, (See 6.2).

TABLE III

SPACECRAFT/CRT DISPLAY

SPACE-CRAFT	CRT DISPLAY FORMAT FIGURE
2TV1-M	1D, 1E, 1F
101	
102-N	1A, 1B, 1C, 1D, 1E
103-N	1A, 1B, 1C, 1D, 1E

3.4.1 Measurements Numbers. Table IV correlates the signal measurement numbers to the scope spacing chart displays and indicates location of measurement within the display.

TABLE IV

MEASUREMENT NUMBER	CRT FIG-LINE	MEASUREMENT NUMBER	CRT FIG-LINE
CG 1020	1A-13	CG 2147	1B-4, 1F-3
1021	1A-6	2150	1B-8
1030	1A-14	2168	1A-4
1031	1A-7	2177	1B-4, 1F-3
1040	1A-15, 1F-5	2180	1B-8
1042	1A-8	2219	1B-11
1051	1A-16	2220	1B-6
1052	1A-17	2221	1B-7
1053	1A-9	2249	1B-11
1070	1A-18	2250	1B-6
1071	1A-10	2251	1B-7
1100	1A-19	2279	1B-11
1110	1A-12, 1F-5	2280	1B-6
1201	1A-24, 1F-6	2281	1B-7
CG 1202	1A-13	CG 2300	1A-20, 1F-7

TABLE IV (Continued)

MEASUREMENT NUMBER	CRT FIG-LINE	MEASUREMENT NUMBER	CRT FIG-LINE
CG 1203	1A-14	CG 2301	1A-21
1207	1A-2	3011	1C-15
1211	1A-15	3021	1C-15
1212	1A-16	3117	1C-18
1220	1A-2	3118	1C-18
1331	1A-17, 1F-6	3140	1C-19
1336	1A-18	3145	1C-20
1500	1A-20	3150	1C-19
1501	1A-6	3155	1C-20
1510	1A-21	3160	1C-23
1511	1A-7	3170	1C-23
1520	1A-22	3721	1C-16, 1F-8
1521	1A-8	3722	1C-16, 1F-8
1530	1A-23	4300	1A-22
1531	1A-9	6020	1A-23
2001	1B-9, 1F-4	6021	1A-24
2021	1B-9, 1F-4	9010	1B-12
2041	1B-9, 1F-4	9011	1B-12
2108	1A-4	9012	1B-12
2117	1B-4, 1F-3	2172/2173	1B-3, 1F-2
2120	1B-8	2112/2113	1B-3, 1F-2
CG 2138	1A-4	CG 2142/2143	1B-3, 1F-2

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1										P	H	A	S	E			D	I	F	F	E	R	E	N	C	E														
2	1	2	0	7		I	M	U		1	/	5					X	X	X		1	2	2	0		O	P	T	/	I	M	U					X	X	X	
3	0	3			Q	U	A	D	R	A	T	U	R	E					O	G				.		I	G						M	G						
4	0	4		S	E	R	V	O		E	R	R						X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
5												N	O	I	S	E		M	E	A	S	U	R	E	M	E	N	T	S		V	R	M	S						
6	1	0	2	1		+	1	4		C	M	C				X	.	X	X		1	5	0	1		+	2	8		O	P					X	.	X	X	
7	1	0	3	1		+		4		C	M	C				X	.	X	X		1	5	1	1		+	2	8	S	T	B	Y				X	.	X	X	
8	1	0	4	2		1	2	0		P	I	P				X	.	X	X		1	5	2	1		+	2	8		C	M	C				X	.	X	X	
9	1	0	5	3		+	2	0		P	I	P				X	.	X	X		1	5	3	1		+	2	8		O	P	T				X	.	X	X	
10	1	0	7	1		+		4		C	D	U				X	.	X	X																					
11																																								
12	1	1	1	0		T	M		B	I	A	S				X	.	X	X																					
13	1	0	2	0		+	1	4		C	M	C				X	X	.	X		1	2	0	2		I	M	U		5	%	-				X	X	.	X	
14	1	0	3	0		+		4		C	M	C				X	.	X	X		1	2	0	3		I	M	U		5	%	0				X	X	.	X	
15	1	0	4	0		1	2	0		P	I	P					X	X	X		1	2	1	1		O	P	T		1	%	0				X	X	.	X	
16	1	0	5	1		+	2	0		P	I	P				X	X	.	X		1	2	1	2		O	P	T		5	%	-				X	X	.	X	
17	1	0	5	2		-	2	0		P	I	P				X	X	.	X		1	3	3	1		3	.	2	K	2	8	V				X	X	.	X	
18	1	0	7	0		+		4		C	D	U				X	.	X	X		1	3	3	6		3	.	2	/	C	M	C					X	X	X	
19	1	1	0	0		-	2	8		S	U	P				X	X	.	X			C	G					T	E	M	P					D	E	G	F	
20	1	5	0	0		+	2	8		O	P					X	X	.	X		2	3	0	0				P	I	P	A				X	X	X	.	X	
21	1	5	1	0		+	2	8	S	T	B	Y				X	X	.	X		2	3	0	1				I	R	I	G				X	X	X	.	X	
22	1	5	2	0		+	2	8		C	M	C				X	X	.	X		4	3	0	0		C	M	C	T	E	M	P					X	X	X	
23	1	5	3	0		+	2	8		O	P	T				X	X	.	X		6	0	2	0		C	A	L		M	O	D					X	X	X	
24	1	2	0	1		I	M	U		1	%	0				X	X	.	X		6	0	2	1		I	M	U		5	%						X	X	X	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT A

FIGURE 1A

SCOPE SPACING CHART
FOR PAGE DISPLAY

AA																																							
1	0	1			I	S	S		M	E	A	S						O	G	/	X					I	G	/	Y					M	G	/	Z			
2	0	2		C	D	U		A	N	G	L	E	S					X	X	X	.	X	X			X	X	X	.	X	X			X	X	X	.	X	X	
3	0	3		G	I	M	B		A	N	G	L	E	S				X	X	X						X	X	X				X	X	X			D	E	G	
4	0	4		S	E	R	V	O		E	R		φ					X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
5																																							
6	0	6		C	D	U		F	I	N	E		E	R				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
7	0	7		C	D	U		C	R	S			E	R				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
8	0	8		T	O	R		M	O	T		C	U	R				.	X	X	X					.	X	X	X			.	X	X	X		A	M	P	S
9	0	9		P	I	P		S	G		O	U	T	φ				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
10																		R	O	L	L				P	I	T	C	H				Y	A	W					
11	1	1		D	A	C		A	T	T		E	R					X	X	.	X					X	X	.	X			X	X	.	X		D	E	G	
12	1	2		D	A	C		T	O		I	U						X	.	X	X					X	.	X	X			X	.	X	X		V	D	C	
13	1	3		E	N	G	I	N	E		O	N					O	F	F		L	I	F	T	O	F	F										O	F	F	
14	1	4		T	V	C		E	N	A	B	L	E				O	F	F		G	U	I	D	N	C	E		R	E	F		R	L			O	F	F	
15	1	5		U	L	L	A	G	E								O	F	F		S	/	C		C	T	L		S	A	T	U	R	N			O	F	F	
16	1	6		S	M		S	E	P	A	R	A	T	E			O	F	F		S	A	T		T	A	K	O	V	R		A	B	L			O	F	F	
17	1	7		S	P	S		R	E	A	D	Y					O	F	F		S	A	T		I	N	J		S	E	Q		S	T			O	F	F	
18	1	8		G	/	N		C	O	N	T	R	O	L			O	F	F		S	A	T		C	U	T	O	F	F							O	F	F	
19	1	9		+	X		T	R	A	N	S						O	F	F		+	P	I	T	C	H		M	A	N		R	O	T			O	F	F	
20	2	0		-	X		T	R	A	N	S						O	F	F		-	P	I	T	C	H		M	A	N		R	O	T			O	F	F	
21	2	1		+	Y		T	R	A	N	S						O	F	F		+	Y	A	W				M	A	N		R	O	T			O	F	F	
22	2	2		-	Y		T	R	A	N	S						O	F	F		-	Y	A	W				M	A	N		R	O	T			O	F	F	
23	2	3		+	Z		T	R	A	N	S						O	F	F		+	R	O	L	L			M	A	N		R	O	T			O	F	F	
24	2	4		-	Z		T	R	A	N	S						O	F	F		-	R	O	L	L			M	A	N		R	O	T			O	F	F	
25																																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT B
FIGURE 1 B

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	S	H	A	F	T		C	D	U		X	X	X	.	X	X		D	E	G		T	R	U	N		C	D	U		X	X	.	X	X	X		D	E	G
2																																								
3	O	P	T		Z	E	R	O	I	N	G						O	F	F		Z	E	R	O		O	P	T		C	D	U	S				O	F	F	
4	O	P	T		S	W	I	T	C	H							X	X	X																					
5	O	P	T		C	D	U		F	A	I	L					O	F	F		I	G	N		O	C	D	U		F	A	I	L				O	F	F	
6	T	R	A	C	K	E	R		F	A	I	L					O	F	F		A	B	L		O	P	T		E	R		C	T	R			O	F	F	
7																																								
8																																								
9																																								
10																																								
11																																								
12																																								
13	S	H	A	F	T		C	D	U		X	X	X	.	X	X		D	E	G		T	R	U	N		C	D	U		X	X	.	X	X	X		D	E	G
14		C	G			S	H	A	F	T		C	D	U								C	G			T	R	U	N		C	D	U							
15	3	0	2	1		F	I	N	E		E	R				X	.	X	X		3	0	1	1		F	I	N	E		E	R				X	.	X	X	
16	3	7	2	1		D	A	C		O	U	T				X	.	X	X		3	7	2	2		D	A	C		O	U	T				X	.	X	X	
17		C	G			S	H	A	F	T		S	X	T		V	R	M	S			C	G			T	R	U	N		S	X	T			V	R	M	S	
18	3	1	1	7		S	R	V	O		E	R				X	.	X	X		3	1	1	8		S	R	V	O		E	R				X	.	X	X	
19	3	1	4	0		T	A	C		O	U	T				X	.	X	X		3	1	5	0		T	A	C		O	U	T				X	.	X	X	
20	3	1	4	5		M	O	T		C	O	N				X	.	X	X		3	1	5	5		M	O	T		C	O	N				X	.	X	X	
21																																								
22		C	G			S	H	A	F	T		S	C	T		V	R	M	S			C	G			T	R	U	N		S	C	T			V	R	M	S	
23	3	1	6	0		T	A	C		O	U	T				X	.	X	X		3	1	7	0		T	A	C		O	U	T				X	.	X	X	
24																																								
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT C
FIGURE 1 C

SCOPE SPACING CHART
FOR PAGE DISPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
AA																																								
1																																								
2																																								
3																																								
4																																								
5																																								
6																																								
7	B	M	A	G	X										X	X	X	X	X		+	P	I	T	C	H		M	I	N		I	M	P			O	F	F	
8	B	M	A	G	Y										X	X	X	X	X		-	P	I	T	C	H		M	I	N		I	M	P			O	F	F	
9	B	M	A	G	Z										X	X	X	X	X		+	Y	A	W				M	I	N		I	M	P			O	F	F	
10	B	M	A	G		C	T	R		A	B	L					O	F	F		-	Y	A	W				M	I	N		I	M	P			O	F	F	
11	L	E	M		A	T	T	A	C	H	E	D					O	F	F		+	R	O	L	L			M	I	N		I	M	P			O	F	F	
12	S	I	V	B		S	E	P	/	A	B	T					O	F	F		-	R	O	L	L			M	I	N		I	M	P			O	F	F	
13	T	E	M	P		C	A	U	T	I	O	N					O	F	F		I	M	U		F	A	I	L									O	F	F	
14	G	I	M	B	A	L		L	O	C	K						O	F	F		I	G	N		I	M	U		F	A	I	L					O	F	F	
15	N	O		A	T	T	I	T	U	D	E						O	F	F		I	M	U		O	P	E	R	A	T	E						O	F	F	
16	I	S	S		W	A	R	N	I	N	G						O	F	F		C	O	A	R	S	E		A	L	I	G	N					O	F	F	
17	C	M	C		W	A	R	N	I	N	G						O	F	F		Z	E	R	O		I	C	D	U	S							O	F	F	
18	O	S	C		A	L	A	R	M								O	F	F		I	M	U		E	R	R		C	T	R						O	F	F	
19	T	E	S	T		A	L	A	R	M	S						O	F	F		I	M	U		C	A	G	E									O	F	F	
20	A	B	L		C	M	C		S	T	B	Y					O	F	F		I	N	I	T	I	A	L	I	Z	E		I	S	S			O	F	F	
21	B	L	O	C	K		U	P	L	I	N	K					O	F	F		I	S	S		T	R	N	O	N		R	Q	S	T			O	F	F	
22	T	E	M	P		I	N		L	I	M						O	F	F		I	S	S		T	R	N	O	N		C	O	M	P			O	F	F	
23	P	I	P	A		F	A	I	L								O	F	F		I	S	S		C	D	U			F	A	I	L				O	F	F	
24	I	G	N		P	I	P		F	A	I	L					O	F	F		I	G	N		I	C	D	U		F	A	I	L				O	F	F	
25																																								

CRT DISPLAY
FORMAT D
FIGURE 1 D

SCOPE SPACING CHART
FOR PAGE DISPLAY

AA																																								
1		U	P	L	I	N	K		A	C	T		C	O	M	P	U	T	E	R		P	R	O	G	R	A	M		V	E	R	B			N	O	U	N	
2	K	S	E	Q									O	K											X	X					X	X					X	X		
3	K	E	Y		R	E	L	E	A	S	E						O	F	F										R	1			X	X	X	X	X			
4	U	P	L	O	C	K											O	F	F										R	2			X	X	X	X	X			
5																													R	3			X	X	X	X	X			
6	U	P	L	N	K		T	O	O		F	A	S	T			O	F	F		O	P	E	R	A	T	O	R		E	R	R					O	F	F	
7	I	N	H	I	B	I	T		U	P	L	I	N	K			O	F	F		P	R	O	G	R	A	M			A	L	M					O	F	F	
8	S	Y	N	C		E	R	R	O	R			X	X							R	E	D	O	C	T	R						X	X	X	X	X			
9	W	O	R	D		E	R	R	O	R			X	X	X	X	X	X	X		F	A	I	L	R	E	G						X	X	X	X	X			
10	R	E	L			E	R	R	O	R			X								P	A	R		E	R	R	O	R				X							
11	V	E	R			E	R	R	O	R			X								K	E	Y		E	R	R	O	R				X	X						
12	C	M	C		T	I	M	E			X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X		S	E	C					
13	T	I	M	E		E	P	O	C	H		X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X	X		S	E	C				
14	T	I	M	E		E	R	R	O	R		X	X	X	X						Δ		T	I	M	E			X	X	X	.	X	X		S	E	C		
15	P	I	P	A		M	E	A	S			X	X	X							H	I		R	A	T	E		M	E	A	S		X	X	X	X	X	X	
16																		O	G							I	G							M	G					
17	1	7		C	D	U		A	N	G	L	E	S			X	X	X	.	X	X			X	X	X	.	X	X			X	X	X	.	X	X	D	E	G
18																																								
19	1	9		P	I	P	A	X							X	X	X	X	X																					
20	2	0		P	I	P	A	Y							X	X	X	X	X		P	I	P	A	N											X	X	X	X	X
21	2	1		P	I	P	A	Z							X	X	X	X	X		P	I	P	A	E											X	X	X	X	X
22	2	2		A	N	G	X			.	X	X	X	X	X		R	A	D		V	D	R	I	F	T	O			X	X	X	.	X	X		M	E	R	U
23	2	3		A	N	G	Y			.	X	X	X	X	X		R	A	D		S	D	R	I	F	T	I			X	X	X	.	X	X		M	E	R	U
24	2	4		A	N	G	Z			.	X	X	X	X	X		R	A	D		E	D	R	I	F	T	T			X	X	X	.	X	X		M	E	R	U
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT E
FIGURE 1 E

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1			I	S	S		M	E	A	S						O	G	/	X					I	G	/	Y					M	G	/	Z			
2	0	2		G	I	M	B		A	N	G	L	E	S				X	X	X						X	X	X				X	X	X			D	E	G	
3	0	3		S	E	R	V	O		E	R		0					X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
4	0	4		P	I	P		S	G		O	U	T	0				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
5	1	0	4	0		1	2	0		P	I	P					X	X	X		1	1	1	0		T	M		B	I	A	S				X	.	X	X	
6	1	2	0	1		I	M	U		1	%					X	X	.	X		1	3	3	1		3	.	2	K	2	8	V				X	X	.	X	
7	2	3	0	0		P	I	P		T	M	P			X	X	X	.	X																					
8	3	7	2	1		S	D	A	C		O	T				X	.	X	X		3	7	2	2		T	D	A	C		O	T				X	.	X	X	
9	O	P	T		Z	E	R	O	I	N	G						O	F	F		Z	E	R	O		O	P	T		C	D	U	S				O	F	F	
10	O	P	T		S	W	I	T	C	H							X	X	X																					
11	O	P	T		C	D	U		F	A	I	L					O	F	F		I	G	N		O	C	D	U		F	A	I	L				O	F	F	
12	T	R	A	C	K	E	R		F	A	I	L					O	F	F		A	B	L		O	P	T		E	R		C	T	R			O	F	F	
13	1	3		E	N	G	I	N	E		O	N					O	F	F		L	I	F	T	O	F	F										O	F	F	
14	1	4		T	V	C		E	N	A	B	L	E				O	F	F		G	U	I	D	N	C	E		R	E	F		R	L			O	F	F	
15	1	5		U	L	L	A	G	E								O	F	F		S	/	C		C	T	L		S	A	T	U	R	N			O	F	F	
16	1	6		S	M		S	E	P	A	R	A	T	E			O	F	F		S	A	T		T	A	K	O	V	R		A	B	L			O	F	F	
17	1	7		S	P	S		R	E	A	D	Y					O	F	F		S	A	T		I	N	J		S	E	Q		S	T			O	F	F	
18	1	8		G		N		C	O	N	T	R	O	L			O	F	F		S	A	T		C	U	T	O	F	F							O	F	F	
19	1	9		+	X		T	R	A	N	S						O	F	F		+	P	I	T	C	H		M	A	N		R	O	T			O	F	F	
20	2	0		-	X		T	R	A	N	S						O	F	F		-	P	I	T	C	H		M	A	N		R	O	T			O	F	F	
21	2	1		+	Y		T	R	A	N	S						O	F	F		+	Y	A	W				M	A	N		R	O	T			O	F	F	
22	2	2		-	Y		T	R	A	N	S						O	F	F		-	Y	A	W				M	A	N		R	O	T			O	F	F	
23	2	3		+	Z		T	R	A	N	S						O	F	F		+	R	O	L	L			M	A	N		R	O	T			O	F	F	
24	2	4		-	Z		T	R	A	N	S						O	F	F		-	R	O	L	L			M	A	N		R	O	T			O	F	F	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT F

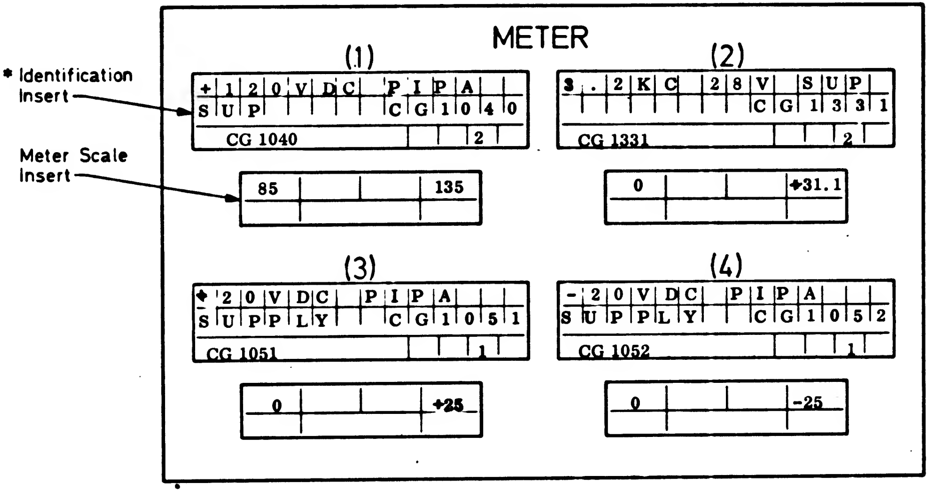
FIGURE 1F

3.5 METER DISPLAYS. The meter display format assignment for each Spacecraft shall be as specified in Table V. Meter scales and color band codings are specified for reference only and may be changed by the user.

TABLE V

METER DISPLAYS

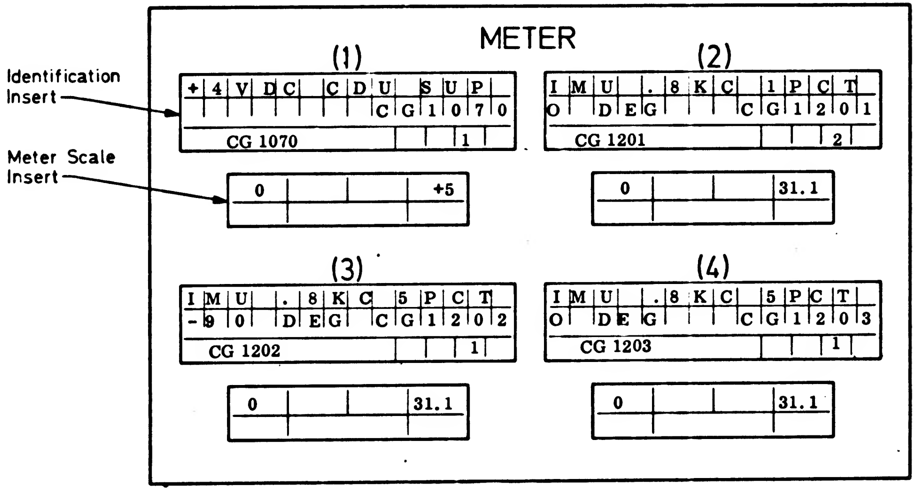
SPACE CRAFT	Console/Panel							
	004A2		004A3				014A1	
	Meter Module		Meter Module				Meter Module	
	A 3 Figure	A 4 Figure	A 6 Fig.	A 7 Fig.	A 8 Fig.	A 9 Fig.	A 3 Figure	A 4 Figure
2TV1-M			2L	2J	2K	2F	2L	
101								
102-N	2A	2B	2C	2D	2E	2F	2G	2H
103-N	2A	2B	2C	2D	2E	2F	2G	2H



* See Figure 7A

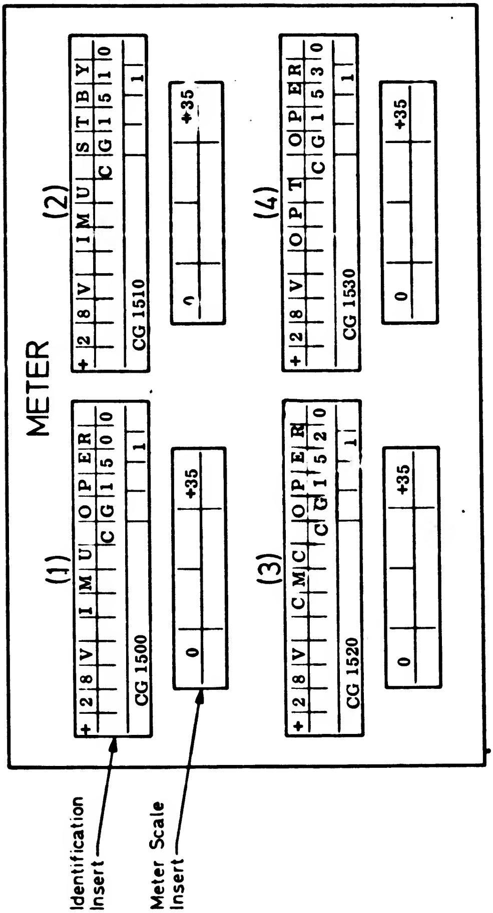
METER DISPLAY A

FIGURE 2 A



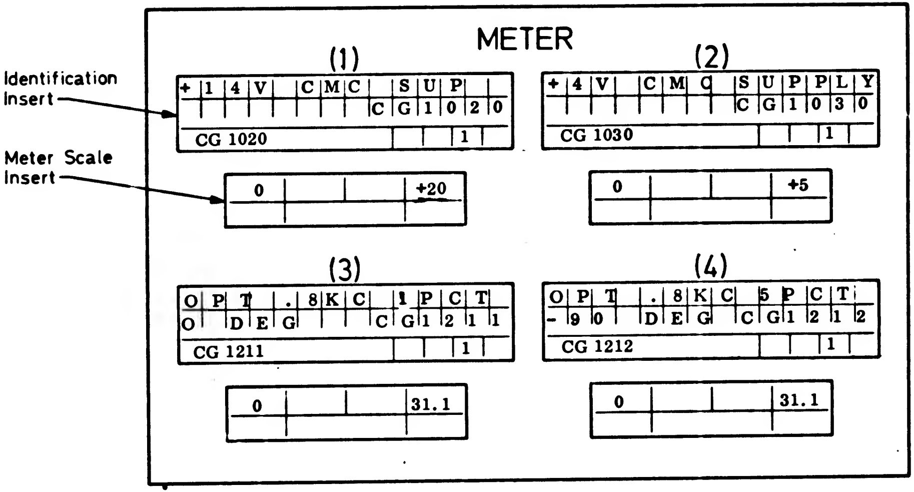
METER DISPLAY B

FIGURE 2 B



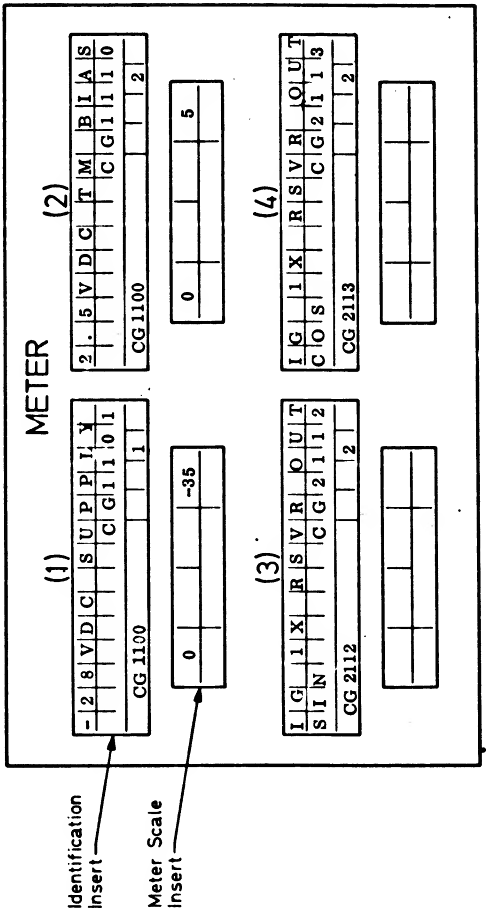
METER DISPLAY C

FIGURE 2 C



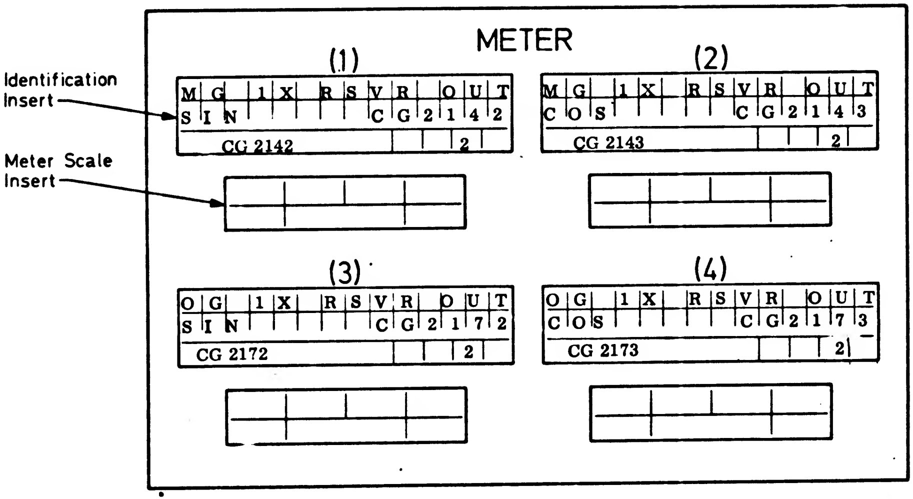
METER DISPLAY D

FIGURE 2D



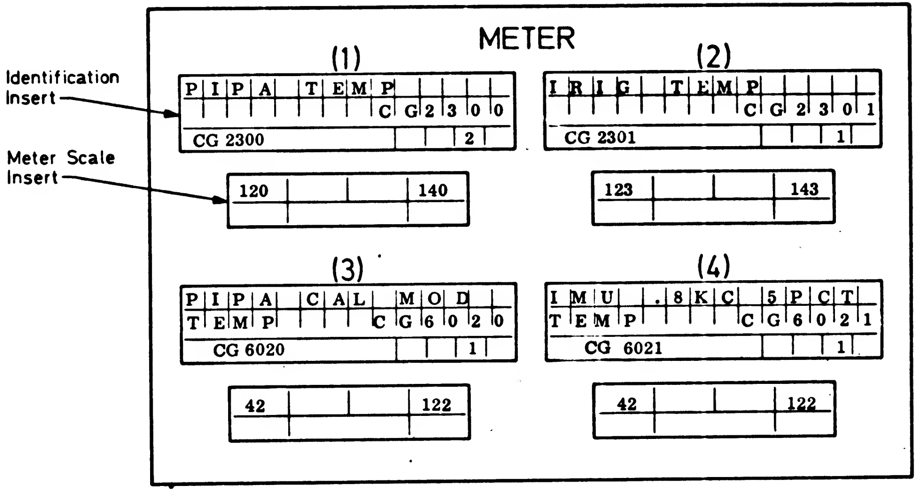
METER DISPLAY E

FIGURE 2 E



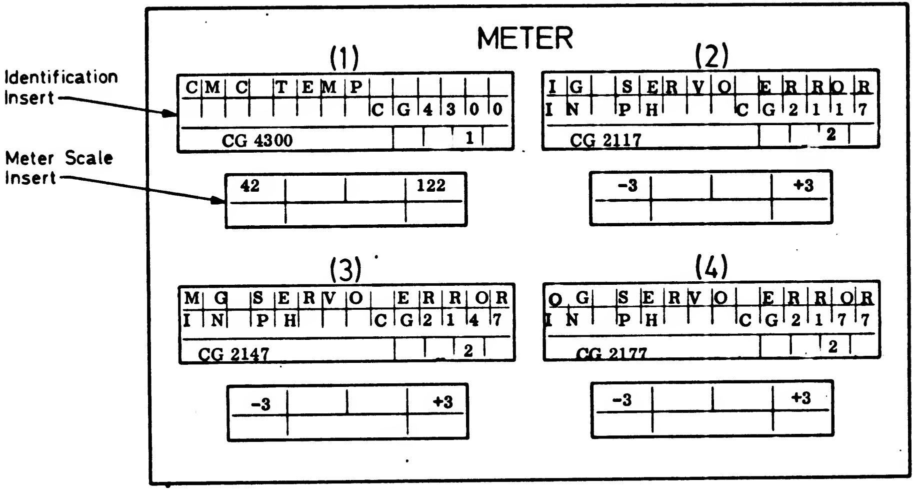
METER DISPLAY F

FIGURE 2 F



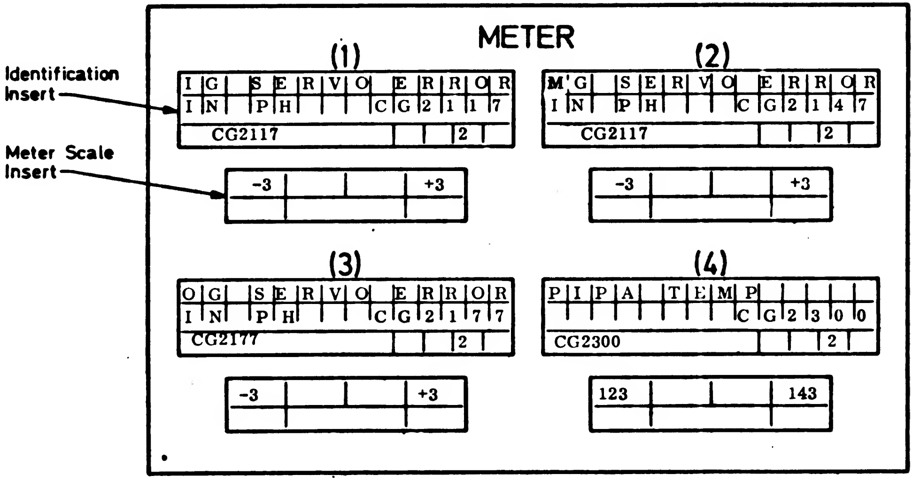
METER DISPLAY G

FIGURE 2 G



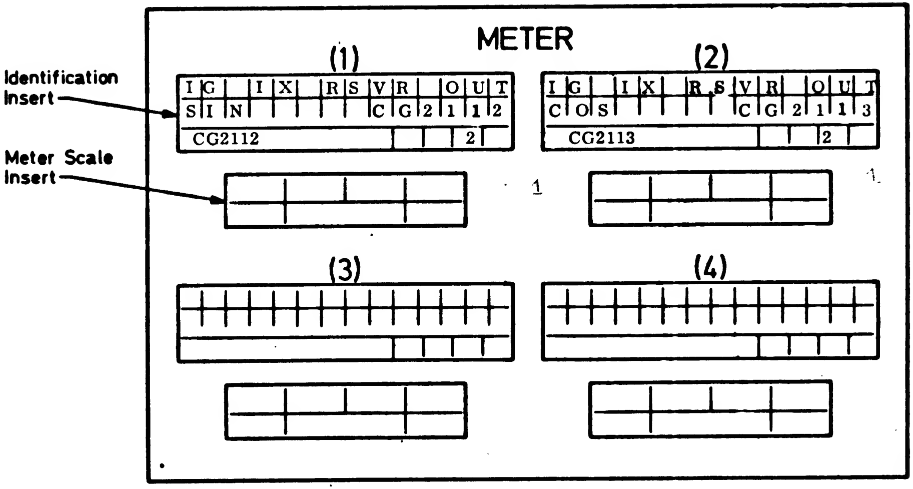
METER DISPLAY H

FIGURE 2 H



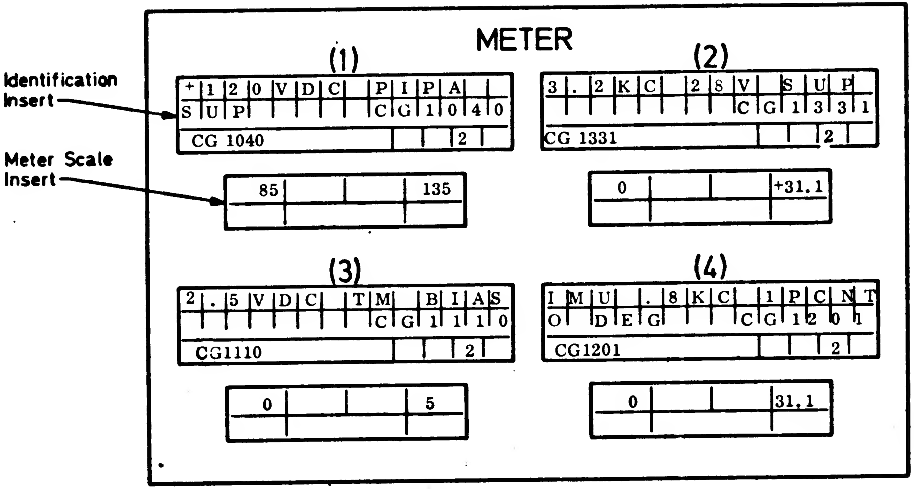
METER DISPLAY J

FIGURE 2J



METER DISPLAY K

FIGURE 2K



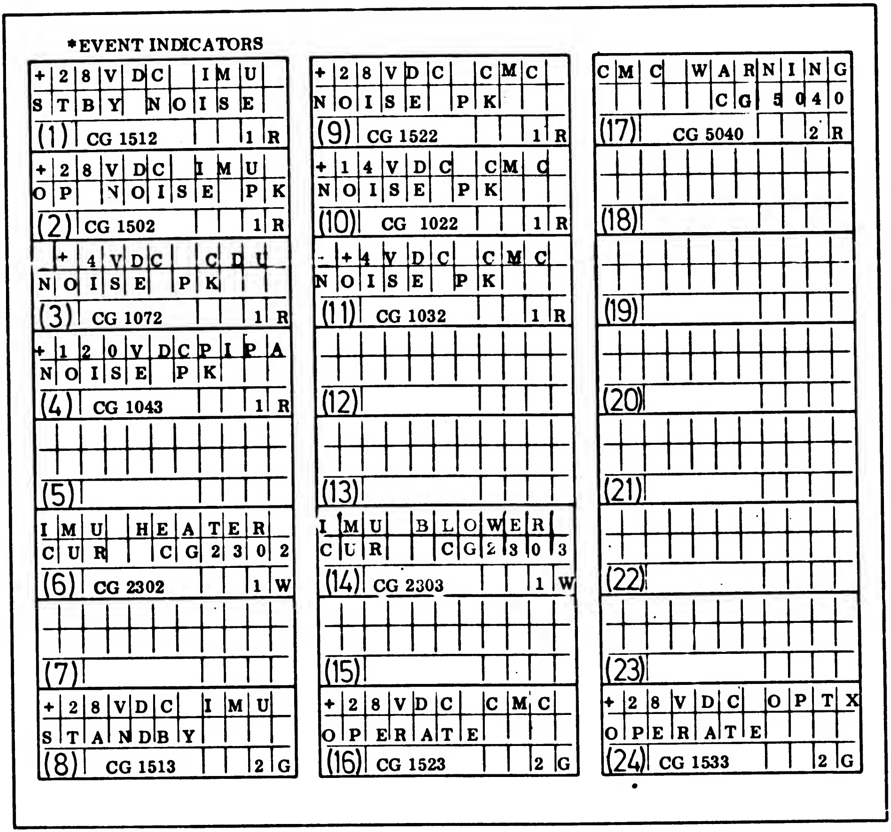
METER DISPLAY L

FIGURE 2 L

3.6 EVENT INDICATOR DISPLAYS. The event indicator display format assignment for each Spacecraft shall be as specified in Table VI.

TABLE VI
EVENT INDICATOR
DISPLAYS

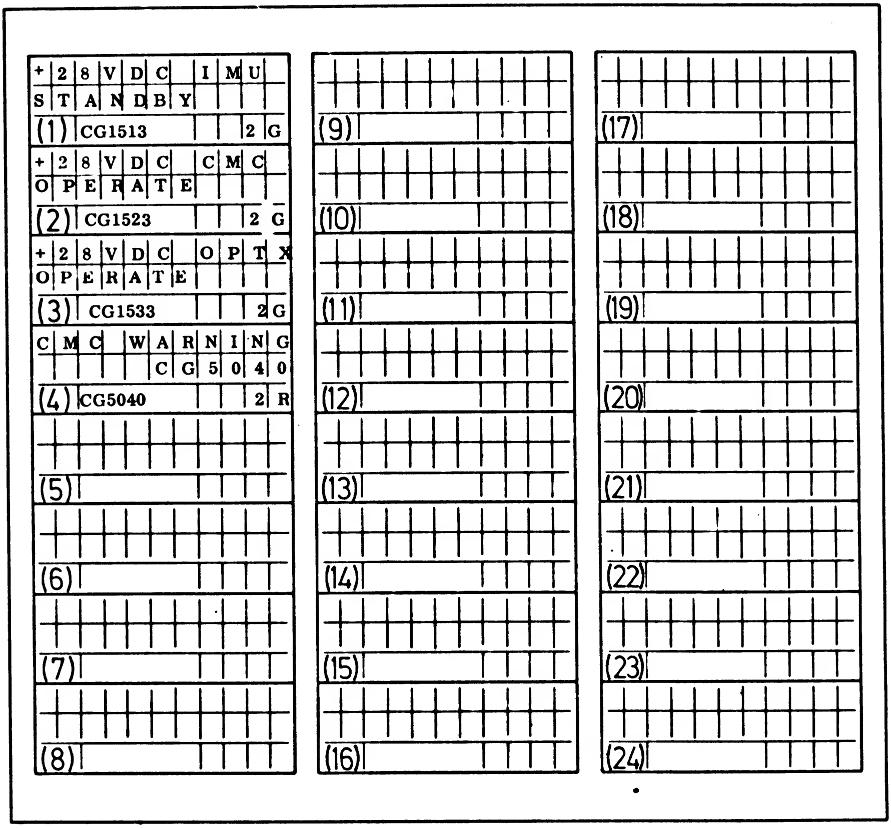
SPACE-CRAFT	CONSOLE/PANEL					
	004A3		014A1		004A4	
	Event	Module	Event	Module	Event	Module
	A 4 Figure	A 5 Figure	A 1 Figure	A 2 Figure		
2TV1-M		3B		3B		
101						
102-N		3A		3A		
103-N		3A		3A		



* See Figure 7B

EVENT INDICATOR DISPLAY A

FIGURE 3 A



EVENT INDICATOR DISPLAY B

FIGURE 3B

3.7 EVENT RECORDER SIGNAL ARRANGEMENT. The signals recorded on the 32 channel Event Recorder, Panel/Module Number 004A2A2, shall be arranged as specified in Table VII.

TABLE VII

EVENT RECORDER SIGNAL ARRANGEMENT

SPACECRAFT	SIGNAL ARRANGEMENT FIGURE
2TV1-M	4B
101	
102-N	4A
103-N	4A

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			
2	CG1032	1	+4 VDC CMC NOISE PK CG1032
3	CG1072	1	+4 VDC CDU NOISE PK CG1072
4	CG1532	1	+28 VDC OPTX NOISE PK CG1532
5	CG2302	1	IMU HEATER CUR CG2302
6			
7			
8			
9	CG1523	2	+28 VDC CMC OPER CG1523
10	CG1513	2	+28 VDC IMU STBY CG1513
11	CG1043	1	+120 VDC PIPA NOISE PK CG1043
12			
13	CG2303	1	IMU BLOWER CUR CG2303
14			
15			
16			
17	CG1522	1	+28 VDC CMC NOISE PK CG1522
18	CG1512	1	+28 VDC IMU STBY NOISE CG1512
19			
20	CG5040	2	CMC WARNING CG5040
21			
22			
23			
24			
25	CG1022	1	+14 VDC CMC NOISE PK CG1022
26	CG1502	1	+28 VDC IMU OP NOISE PK CG1502
27	CG1533	2	+28 VDC OPTX OPER CG1533
28			
29			
30			
31			
32			
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

EVENT RECORDER

SIGNAL ARRANGEMENT

FIGURE 4A

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			
2	CG1513	2	+28 VDC IMU STANDBY
3	CG1523	2	+28 VDC CMC OPERATE
4	CG1533	2	+28 VDC OPTX OPERATE
5	CG5040	2	CMC WARNING
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

EVENT RECORDER

SIGNAL ARRANGEMENT

FIGURE 4B

CHANNEL

1	2	3
SXT SHAFT SERVO ERROR IN PH CG 3117	SXT TRUN SERVO ERROR IN PH CG 3118	SHAFT CDU FINE ERROR RMS CG 3021
Measurement No. CG 3117 Link No. 1	Measurement No. CG 3118 Link No. 1	Measurement No. CG 3021 Link No. 1

4	5	6
TRUN CDU FINE ERROR RMS CG 3011	SXT SHAFT TACH OUTPUT IN PH CG 3140	SXT TRUN TACH OUTPUT IN PH CG 3150
Measurement No. CG 3011 Link No. 1	Measurement No. CG 3140 Link No. 1	Measurement No. CG 3150 Link No. 1

7	8
SHAFT CDU DAC OUTPUT CG 3721	TRUN CDU DAC OUTPUT CG 3722
Measurement No. CG 3721 Link No. 2	Measurement No. CG 3722 Link No. 2

8 CHANNEL ANALOG RECORDER
SIGNAL ARRANGEMENT A

FIGURE 5 A

CHANNEL

1	2	3
HI RATE CHANNEL	+14V CMC SUPPLY DC LEVEL CG 1020	+4V CMC SUPPLY DC LEVEL CG 1030
Measurement No. Link No.	Measurement No. CG 1020 Link No. 1	Measurement No. CG 1030 Link No. 1

4	5	6
PITCH ATT ERR - CDU DAC OUT IN PH CG 2219	YAW ATT ERR - CDU DAC OUT IN PH CG 2249	ROLL ATT ERR - CDU DAC OUT IN PH CG 2279
Measurement No. CG 2219 Link No. 1	Measurement No. CG 2249 Link No. 1	Measurement No. CG 2279 Link No. 1

7	8
PIPA TEMPERATURE CG 2300	IRIG TEMPERATURE CG 2301
Measurement No. CG 2300 Link No. 2	Measurement No. CG 2301 Link No. 1

8 CHANNEL ANALOG RECORDER
SIGNAL ARRANGEMENT B

FIGURE 5 B

3.8 ANALOG RECORDER SIGNAL ARRANGEMENT. The signals recorded on the Analog Recorder shall be arranged as specified in Table VIII.

TABLE VIII

ANALOG RECORDER SIGNAL ARRANGEMENT

SPACECRAFT	CONSOLE/ PANEL		
	004A1		004A3
	Analog Module		Analog Module
	A 2	A 3	A 02
2TV1-M	Fig 5D	Fig. 5E	
101			
102-N	Fig. 5A	Fig. 5B	Fig. 5C
103-N	Fig. 5A	Fig. 5B	Fig. 5C

SWITCH POSITION

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	CG 2120	1	IG TORQUE MOT CURRENT CG 2120
1	2	CG 2177	2	OG SERVO ERROR IN PH CG 2177
1	3	CG 3145	1	SXT SHAFT MOT CONT WD CG 3145
1	4			
2	1	CG 6020	1	PIPA CAL MOD TEMP CG 6020
2	2	CG 2180	1	OG TORQUE MOT CURRENT CG 2180
2	3	CG 2147	2	MG SERVO ERROR IN PH CG 2147
2	4			
3	1	CG 2117	2	IG SERVO ERR IN PH CG 2117
3	2	CG 3155	1	SXT TRUN MOT CONT WD CG 3155
3	3	CG 2150	1	MG TORQUE MOT CURRENT CG 2150
3	4			
4	1	CG 2112	2	IG 1 X RSVR OUT SIN CG 2112
4	2	CG 2280	1	OG CDU FINE ERROR CG 2280
4	3	CG 2143	2	MG 1X RSVR OUT COS CG 2143
4	4			
5	1	CG 2113	2	IG 1X RSVR OUT COS CG 2113
5	2	CG 2172	2	OG 1X RSVR OUT SIN CG 2172
5	3	CG 2250	1	MG CDU FINE ERROR CG 2250
5	4			
6	1	CG 2220	1	IG CDU FINE ERROR CG 2220
6	2	CG 2173	2	OG 1X RSVR OUT COS CG 2173
6	3	CG 2142	2	MG 1X RSVR OUT SIN CG 2142
6	4			
7	1	CG 4300	1	CMC TEMP CG 4300
7	2	CG 1520	1	+28V CGC OPER CG 1520
7	3	CG 3170	2	SCT TRUN TACH OUT CG 3170
7	4			
8	1	CG 1201	2	IMU 28 V 1 PCT CG 1201
8	2	CG 1040	2	+120V PIPA SUP CG 1040
8	3	CG 3160	2	SCT SHAFT TACH OUT CG 3160
8	4			
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

32 CHANNEL ANALOG RECORDER

SIGNAL ARRANGEMENT C

FIGURE 5 C

1	2	3
IG 1X RSVR OUT SIN CG2112	IG 1X RSVR OUT COS CG2113	MG 1X RSVR OUT SIN CG2142
Measurement No. CG2112 Link No. 2	Measurement No. CG2113 Link No. 2	Measurement No. CG2142 Link No. 2

4	5	6
MG 1X RSVR OUT COS CG2143	OG 1X RSVR OUT SIN CG2172	OG 1X RSVR OUT COS CG2173
Measurement No. CG2143 Link No. 2	Measurement No. CG2172 Link No. 2	Measurement No. CG2173 Link No. 2

7	8
3.2KC 28V SUPPLY CG1331	IMU 28V 1PCT CG1201
Measurement No. CG1331 Link No. 2	Measurement No. CG1201 Link No. 2

8 CHANNEL ANALOG RECORDER

SIGNAL ARRANGEMENT D

FIGURE 5D

1	2	3
HI RATE CHANNEL	IG SERVO ERR IN PH CG2117	MG SERVO ERR IN PH CG2147
Measurement No. Link No.	Measurement No. CG2117 Link No. 2	Measurement No. CG2147 Link No. 2

4	5	6
OG SERVO ERR IN PH CG2177	PIPA TEMPERATURE CG2300	+120V PIPA SUPPLY CG1040
Measurement No. CG2177 Link No.	Measurement No. CG2300 Link No. 2	Measurement No. CG1040 Link No. 2

7	8
SHAFT CDU DAC OUTPUT CG3721	TRUN CDU DAC OUTPUT CG3722
Measurement No. CG3721 Link No. 2	Measurement No. CG3722 Link No. 2

8 CHANNEL ANALOG RECORDER

SIGNAL ARRANGEMENT E

FIGURE 5E

3.9 R-START SIGNAL ARRANGEMENT. The R-START signal arrangement for each Spacecraft shall be as specified in Table IX.

TABEL IX:

R-START SIGNAL ARRANGEMENT

SPACECRAFT	CONSOLE/PANEL	
	004A2	004A4
	Module A6	Module A5
2TV1-M	Figure 6B	Figure 6A
101		
102-N	Figure 6B	Figure 6A
103-N	Figure 6B	Figure 6A

R-START 144				R-START 145			
			G&N ERROR RESET KZ0014				
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START 146				R-START 147			
	Special K-Start Verify KZ0016	Special K-Start Load Verify KZ0015		PIPA Reference Commands KG7009	X PIPA Output Commands KG7010	Y PIPA Output Commands KG7011	Z PIPA Output Commands KG7012
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START SIGNAL ARRANGEMENT A

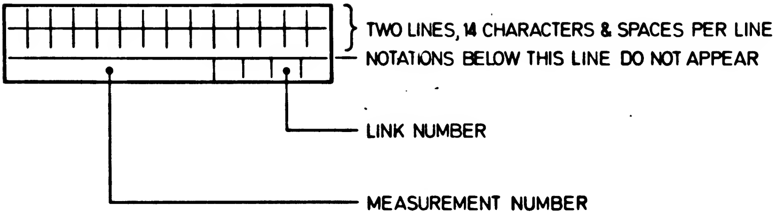
FIGURE 6A

R-START 152				R-START 153			
	CMC TIME X MISSION KZ 0013	CMC TIME CORRECTION & VERIF. KZ0012	CMC CLOCK INITIAL. KZ 0011				
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

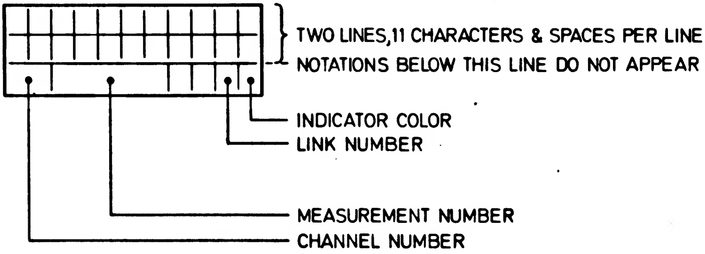
R-START 154				R-START 155			
	CMC 14 VOLT STIMULI DAC 8 KG 7021	CMC 4 VOLT STIMULI DAC 7 KC 7020	CMC MARGIN TEST ENABLE KG 7019	IGA STEP COMMAND KG 7013	MGA STEP COMMAND KG 7014	OGA STEP COMMAND KG 7015	
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START SIGNAL ARRANGEMENT B

FIGURE 6 B


TWO LINES, 14 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
LINK NUMBER
MEASUREMENT NUMBER

7 A. - METER IDENTIFICATION INSERT


TWO LINES, 11 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
INDICATOR COLOR
LINK NUMBER
MEASUREMENT NUMBER
CHANNEL NUMBER

7 B. - EVENT INDICATOR DISPLAY FORMAT

FIGURE 7

4. QUALITY ASSURANCE PROVISIONS

4.1 INSPECTION. The requirements specified in Section 3 shall be verified by visual inspection.

5. PREPARATION FOR DELIVERY. This section is not applicable to this specification.

6. NOTES.

6.1 VARIATIONS TO SIGNAL ARRANGEMENT. Signal arrangements within a display module or assembly may be varied, but the signals shall be retained by the original module or assembly specified. The signal arrangement for the CRT display (3.4) shall be restricted to variations within the half page specified.

6.2 SPACECRAFT LOCATION. The letter following the spacecraft number indicates the location of the spacecraft. Locations are as follows:

	Applicable At
-G	Grumman Aircraft
-F	KSC
-M	MSC
-N	NAA
No letter	Applicable at all locations

APOLLO G&N Specification
ND1002321 REV – B
Original Issue Date:
Release Authority: TDRR 31344
Class A Release
CODE IDENT NO. 99974

G&N PROGRAMMING REQUIREMENTS
(DISPLAYS & CONTROLS)
FOR
ACCEPTANCE CHECKOUT EQUIPMENT
(BLOCK II)

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
				AC	NASA
11/1/66	A	31761	3-33 Was 33 pages, now 42 pgs.	EA	WLS
12/8/66	B	32261	2-4, 6-8, 12, 14-42 was 42	EA	--
			pages, now 44 pages		

This specification consists of page 1 to 44 inclusive.

APPROVALS	NASA/MSC	MIT/IL	AC

1. SCOPE

1.1 PURPOSE. This specification establishes the G&N programming requirements for signal arrangements displays, and limits during post-installation checkout of a Spacecraft using Acceptance Checkout Equipment (ACE). (See 6.1, 6.2, and 6.3).

2. APPLICABLE DOCUMENTS

2.1 EFFECTIVE ISSUES. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, Military Standards and Specifications shall be that issue in effect on the date of request for proposal or invitation to bid.

SPECIFICATIONS

APOLLO G&N

ND1002319	ACE-S/C Computer Subprogram Specification for APOLLO CM and LM G&N Testing

North American Aviation

MA0201	NAA Acceptance Checkout Equipment - SC Programming Requirements

(Copies of specifications, standards, drawings, bulletins, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 CONFLICTING REQUIREMENTS. In the event of a conflict between requirements, the following order of precedence shall apply.

a. The contract.
b. This specification.
c. Documents listed in this specification.

3. REQUIREMENTS

3.1 G&N SPACECRAFT SUBPROGRAMS. The subprograms contained in Specification ND1002319 shall be used for the applicable Spacecraft configuration as specified in Table I.

TABLE I
SUBPROGRAMS

SPACECRAFT (Use Subprogram indicated with "X")	AC ELECTRONICS G&N SUBPROGRAMS											
	181	221A	224A	601	602	603	622A	631	632	641	652	671
2TVI-M		X	X				X	X	X		X	X
101-K	X	X	X	X	X	X	X	X	X	X	X	X
102-N	X	X	X				X	X	X	X	X	X
103-N	X	X	X				X	X	X	X	X	X
104-N	X	X	X				X	X	X	X	X	X

3.2 SIGNAL BLINK LIMITS. The following signal blink limits shall apply to all G&N Spacecraft.

a. The following signals shall have blink limits equal to tolerances specified in the applicable NAA Acceptance Checkout Equipment-SC Programming Requirements process Specification MA0201.

CG 1020
CG 1030
CG 1040
CG 1051
CG 1052
CG 1070
CG 1100
CG 1110
CG 1201
CG 1202
CG 1203
CG 1211
CG 1212
CG 1331
CG 1500
CG 1510
CG 1520
CG 1530

b. The following signals shall have blink limits of ±4095:

CG 1021
CG 1031
CG 1042
CG 1053
CG 1071
CG 1207
CG 1220
CG 1336
CG 1501
CG 1511
CG 1521
CG 1531
CG 2001
CG 2022
CG 2041
CG 2108
CG 2117
CG 2120
CG 2138
CG 2147
CG 2150
CG 2168
CG 2177
CG 2180
CG 2219
CG 2220
CG 2221
CG 2249
CG 2250
CG 2251
CG 2279
CG 2280
CG 2281
CG 2300
CG 2301
CG 3011
CG 3021
CG 3117
CG 3118
CG 3140
CG 3145
CG 3150
CG 3155
CG 3160
CG 3170
CG 3721
CG 3722
CG 4300
CG 6020
CG 6021
CG 8200
CG 8253
CG 8254
CG 8255
CG 8259
CG 8260
CG 8261
CG 8265
CG 8266
CG 8267
CG 8271
CG 8272
CG 8273
CG 8277
CG 8278
CG 8279
CG 9010
CG 9011
CG 9012
CG 9015
CG 9016
CG 9017
CG 9018

3.3 HIGH RATE MEASUREMENTS. The C START Panel shall program the signals specified in Table II, in response to the entry selected on the C START panel, to the channel specified on the GSE Carryon G&N Signal Conditioning and Switching Matrix Unit, C14-213, (SCSMU).

3.4 CRT DISPLAYS. The CRT screen on the CRT module shall display information for each Spacecraft in accordance with Table III.

TABLE III

SPACECRAFT/CRT DISPLAY

SPACECRAFT	CRT DISPLAY FORMAT FIGURE
2TV1-M	1D, 1E, 1F, 1M
101-K	1G, 1H, 1J, 1K, 1L
102-N	1A, 1B, 1C, 1D, 1E
103-N	1A, 1B, 1C, 1D, 1E
104-N	1A, 1B, 1C, 1D, 1E

3.4.1 Measurements Numbers. Table IV correlates the signal measurement numbers to the scope spacing chart displays and indicates location of measurement within the display.

TABLE IV

CG MEASURE-MENT NUMBER	CRT FIG. 1-LINE	CG MEASURE-MENT NUMBER	CRT FIG. 1-LINE
1020	A-13, H-15	2177	B-4, F-3, K-5
1021	A-6, H-15	2180	B-8, K-4
1030	A-14, H-16	2219	B-11, K-16
1031	A-7, H-16	2220	B-6, K-10
1040	A-15, F-5, H-21	2221	B-7, K-9
1042	A-8, H-21	2249	B-11, K-16
1051	A-16, H-22	2250	B-6, K-10
1052	A-17, H-23	2251	B-7, K-9
1053	A-9, H-22	2279	B-11, K-16
1070	A-18, H-20	2280	B-6, K-10
1071	A-10, H-20	2281	B-7, K-9
1100	A-19, H-24	2300	A-20, F-7, H-8
1110	A-12, F-5, H-24	2301	H-9
1201	A-24, F-6, H-7	3011	C-15, J-16
1202	A-13, H-8	3021	C-15, J-16
1203	A-14, H-9	3117	C-18, J-17
1207	A-2, H-3	3118	C-18, J-17
1211	A-15, H-11	3140	C-19, J-18
1212	A-16, H-12	3145	C-20, J-19
1220	A-2, H-4	3150	C-19, J-18
1331	A-17, F-6, H-10	3155	C-20, J-19
1336	A-18, H-5	3160	C-23, J-20
1500	A-20, H-19	3170	C-23, J-20
1501	A-6, H-19	3721	C-16, F-8, J-15
1510	A-21, H-18	3722	C-16, F-8, J-15
1511	A-7, H-18	4300	A-22, H-10
1520	A-22, H-14	6020	A-23, H-11
1521	A-8, H-14	6021	A-24, H-12
1530	A-23, H-17	8200	M-2
1531	A-9, H-17	8253	M-2
2001	B-9, F-4, K-3	8254	M-3
2021	B-9, F-4, K-3	8255	M-4
2041	B-9, F-4, K-3	8259	M-5
2108	A-4, K-6	8260	M-6
2112	K-7	8261	M-7
2112/2113	B-3, F-2, K-15	8265	M-3
2113	K-8	8266	M-4
2142	K-7	8267	M-5
2142/2143	B-3, F-2, K-15	8271	M-8
2143	K-8	8272	M-9
[illegible]	[illegible]	8273	M-10
2147	B-4, F-3, K-5	8277	M-6
2150	B-8, K-4	8278	M-7
2168	A-4, K-6	8279	M-8
2172	K-7	9010	B-12, K-17
2172/2173	B-3, F-2, K-15	9011	B-12, K-17
2173	K-8	9012	B-12, K-17

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1											P	H	A	S	E			D	I	F	F	E	R	E	N	C	E													
2	1	2	0	7		I	M	U		1	/	5					X	X	X		1	2	2	0		O	P	T	/	I	M	U					X	X	X	
3	0	3			Q	U	A	D	R	A	T	U	R	E					O	G						I	G						M	G						
4	0	4		S	E	R	V	O		E	R	R						X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
5												N	O	I	S	E		M	E	A	S	U	R	E	M	E	N	T	S		V	R	M	S						
6	1	0	2	1		+	1	4		C	M	C				X	.	X	X		1	5	0	1		+	2	8		O	P					X	.	X	X	
7	1	0	3	1		+		4		C	M	C				X	.	X	X		1	5	1	1		+	2	8	S	T	B	Y				X	.	X	X	
8	1	0	4	2		1	2	0		P	I	P				X	.	X	X		1	5	2	1		+	2	8		C	M	C				X	.	X	X	
9	1	0	5	3		+	2	0		P	I	P				X	.	X	X		1	5	3	1		+	2	8		O	P	T				X	.	X	X	
10	1	0	7	1		+		4		C	D	U				X	.	X	X																					
11																																								
12	1	1	1	0		T	M		B	I	A	S				X	.	X	X																					
13	1	0	2	0		+	1	4		C	M	C				X	X	.	X		1	2	0	2		I	M	U		5	%	-				X	X	.	X	
14	1	0	3	0		+		4		C	M	C				X	.	X	X		1	2	0	3		I	M	U		5	%	0				X	X	.	X	
15	1	0	4	0		1	2	0		P	I	P					X	X	X		1	2	1	1		O	P	T		1	%	0				X	X	.	X	
16	1	0	5	1		+	2	0		P	I	P				X	X	.	X		1	2	1	2		O	P	T		5	%	-				X	X	.	X	
17	1	0	5	2		-	2	0		P	I	P				X	X	.	X		1	3	3	1		3	.	2	K	2	8	V				X	X	.	X	
18	1	0	7	0		+		4		C	D	U				X	.	X	X		1	3	3	6		3	.	2	/	C	M	C					X	X	X	
19	1	1	0	0		-	2	8		S	U	P				X	X	.	X			C	G					T	E	M	P					D	E	G	F	
20	1	5	0	0		+	2	8		O	P					X	X	.	X		2	3	0	0				P	I	P	A				X	X	X	.	X	
21	1	5	1	0		+	2	8	S	T	B	Y				X	X	.	X																					
22	1	5	2	0		+	2	8		C	M	C				X	X	.	X		4	3	0	0		C	M	C	T	E	M	P					X	X	X	
23	1	5	3	0		+	2	8		O	P	T				X	X	.	X		3	0	2	0		C	A	L		M	O	D					X	X	X	
24	1	2	0	1		I	M	U		1	%	0				X	X	.	X		6	0	2	1		I	M	U		5	%						X	X	X	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT A

FIGURE 1A

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																									
1		U	P	L	I	N	K		A	C	T		C	O	M	P	U	T	E	R		P	R	O	G	R	A	M		V	E	R	B			N	O	U	N		
2	K	S	E	Q									O	K											X	X					X	X					X	X			
3	K	E	Y		R	E	L	E	A	S	E						O	F	F										R	1			X	X	X	X	X				
4	U	P	L	O	C	K											O	F	F										R	2			X	X	X	X	X				
5	G	N		T	R		C	O	N	T	R	L		X	X	X		M	S										R	3			X	X	X	X	X				
6	U	P	L	N	K		T	O	O		F	A	S	T			O	F	F		O	P	E	R	A	T	O	R		E	R	R					O	F	F		
7	I	N	H	I	B	I	T		U	P	L	I	N	K			O	F	F		P	R	O	G	R	A	M			A	L	M					O	F	F		
8	S	Y	N	C		E	R	R	O	R			X	X							R	E	D	O	C	T	R						X	X	X	X	X				
9	W	O	R	D		E	R	R	O	R			X	X	X	X	X	X	X		F	A	I	L	R	E	G						X	X	X	X	X				
10	R	E	L			E	R	R	O	R			X								P	A	R		E	R	R	O	R				X								
11	V	E	R			E	R	R	O	R			X								K	E	Y		E	R	R	O	R				X	X							
12	C	M	C		T	I	M	E			X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X		S	E	C						
13	T	I	M	E		E	P	O	C	H		X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X	X		S	E	C					
14	T	I	M	E		E	R	R	O	R		X	X	X	X						Δ		T	I	M	E			X	X	X	.	X	X		S	E	C			
** 15	P	I	P	A		M	E	A	S			X	X	X							H	I		R	A	T	E		M	E	A	S		X	X	X	X	X	X		**
16																		O	G							I	G							M	G						
17	1	7		C	D	U		A	N	G	L	E	S			X	X	X	.	X	X			X	X	X	.	X	X			X	X	X	.	X	X	D	E	G	
** 18	1	8		F	S				E	R	R		X																												
19	1	9		P	I	P	A	X							X	X	X	X	X																						
20	2	0		P	I	P	A	Y							X	X	X	X	X		P	I	P	A	N											X	X	X	X	X	
21	2	1		P	I	P	A	Z							X	X	X	X	X		P	I	P	A	E											X	X	X	X	X	
22	2	2		A	N	G	X			.	X	X	X	X	X		R	A	D		V	D	R	I	F	T	O			X	X	X	.	X	X		M	E	R	U	
23	2	3		A	N	G	Y			.	X	X	X	X	X		R	A	D		S	D	R	I	F	T	I			X	X	X	.	X	X		M	E	R	U	
24	2	4		A	N	G	Z			.	X	X	X	X	X		R	A	D		E	D	R	I	F	T	T			X	X	X	.	X	X		M	E	R	U	
* 18	S	H	A	F	T		C	D	U		X	X	X	.	X	X		D	E	G		T	R	U	N		C	D	U		X	X	.	X	X	X		D	E	G	
	1	2	3	4	5	6.	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	

* Replaces Line 18, 2TV1 only,

** Not applicable 2TV1

CRT DISPLAY
FORMAT E
FIGURE 1 E

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1					A	C	T	I	V	I	T	Y							P	R	O	G	R	A	M				V	E	R	B		N	O	U	N	
2	0	2		U	P	L	I	N	K		C	O	M	P	U	T	E	R					X	X								X	X				X	X		
3	0	3		I	S	S		M	O	D	E		X	X	X	X	X	X											R	1			X	X	X	X	X			
4	0	4		T	E	M	P		C	A	U	T	I	O	N			X	X										R	2			X	X	X	X	X			
5	0	5		R	E	D	O	C	T	R			X	X	X	X	X												R	3			X	X	X	X	X			
6	0	6		C	M	C		T	I	M	E			X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X		S	E	C		
7	0	7		O	C	D	U				F	A	I	L				X	X		O	P	E	R	A	T	O	R		E	R	R						X	X	
8	0	8		T	R	K	E	R			F	A	I	L				X	X		P	R	O	G	R	A	M			A	L	M						X	X	
9	0	9		I	M	U					F	A	I	L				X	X		K	E	Y		R	E	L	E	A	S	E							X	X	
10	1	0		P	I	P	A				F	A	I	L				X	X		I	N	H	I	B		U	P	L	N	K							X	X	
11	1	1		I	S	S	C	D	U		F	A	I	L				X	X		C	M	C		W	A	R	N	I	N	G							X	X	
12	1	2		I	S	S		W	A	R	N	I	N	G				X	X		G	I	M	B	A	L		L	O	C	K							X	X	
13	1	3		W	O	R	D		E	R	R		X	X	X	X	X	X	X		O	S	C		A	L	A	R	M	S								X	X	
14	1	4		S	Y	N	C		E	R	R		X	X							T	E	S	T		A	L	A	R	M	S							X	X	
15	1	5		R	E	L			E	R	R		X								B	L	O	C	K		U	P	L	N	K							X	X	
16	1	6		K	E	Y			E	R	R		X	X							U	P	L	O	C	K												X	X	
17	1	7		P	A	R			E	R	R		X								U	P	L	N	K		F	A	S	T								X	X	
18	1	8		V	E	R			E	R	R		X	X	X	X	X				I	G	N		I	M	U			F	A	I	L					X	X	
19	1	9		F	S				E	R	R		X								I	G	N		P	I	P	A		F	A	I	L					X	X	
20	2	0		T	I	M	E		E	R	R		X	X	X	X					I	G	N		I	C	D	U		F	A	I	L					X	X	
21	2	1		K	S	E	Q						O	K							F	A	I	L	R	E	G								X	X	X	X	X	
22	2	2		G	N		T	R		C	O	N		X	X	X		M	S		P	I	P	A		M	E	A	S								X	X	X	
23	2	3		Δ	T	I	M	E		X	X	X	.	X	X	X	S	E	C		H	I		R	A	T	E							C	G	X	X	X	X	
24	2	4		T	I	M	E		E	P				X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X	X		S	E	C	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT G
FIGURE 1G

**SCOPE SPACING CHART
FOR PAGE DISPLAY**

AA																																								
1	0	1		P	I	P	A	N							X	X	X	X	X		P	I	P	A	E										X	X	X	X	X	
2		C	G			P	H		D	I	F	F				D	E	G																						
3	1	2	0	7		I	M	U		1	/	5				X	X	X																						
4	1	2	2	0		O	P	T	/	I	M	U				X	X	X																						
5	1	3	3	6		3	.	2	/	C	M	C				X	X	X																						
6		C	G				S	U	P	P	L	Y				V	R	M	S																					
7	1	2	0	1		I	M	U		1	%	0				X	X	.	X			C	G				T	E	M	P						D	E	G	F	
8	1	2	0	2		I	M	U		5	%	0				X	X	.	X		2	3	0	0		P	I	P	A						X	X	X	.	X	
9	1	2	0	3		I	M	U		5	%	0				X	X	.	X		2	3	0	0		I	R	I	G						X	X	X	.	X	
10	1	3	3	1		2	8	V	3	.	2	H				X	X	.	X		4	5	0	0		C	M	C	T	E	M	P				X	X	X		
11	1	2	1	1		O	P	T		1	%	0				X	X	.	X		6	0	2	0		C	A	L		M	O	D				X	X	X		
12	1	2	1	2		O	P	T		5	%	0				X	X	.	X		6	0	2	1		P	S	A	T	E	M	P				X	X	X		
13		C	G				S	U	P	P	L	Y					V	D	C			C	G				N	O	I	S	E					V	R	M	S	
14	1	5	2	0		+	2	8		C	M	C				X	X	.	X		1	5	2	1		+	2	8		C	M	C				X	.	X	X	
15	1	0	2	0		+	1	4		C	M	C				X	X	.	X		1	0	2	1		+	1	4		C	M	C				X	.	X	X	
16	1	0	3	0		+		4		C	M	C				X	.	X	X		1	0	3	1		+		4		C	M	C				X	.	X	X	
17	1	5	3	0		+	2	8		O	P	T				X	X	.	X		1	5	3	1		+	2	8		O	P	T				X	.	X	X	
18	1	5	1	0		+	2	8		S	B	Y				X	X	.	X		1	5	1	1		+	2	8		S	B	Y				X	.	X	X	
19	1	5	0	0		+	2	8		O	P	R				X	X	.	X		1	5	0	1		+	2	8		O	P	R				X	.	X	X	
20	1	0	7	0		+		4		C	D	U				X	.	X	X		1	0	7	1		+		4		C	D	U				X	.	X	X	
21	1	0	4	0		1	2	0		P	I	P				X	X	X			1	0	4	2		1	2	0		P	I	P				X	.	X	X	
22	1	0	5	1		+	2	0		P	I	P				X	X	.	X		1	0	5	3		+	2	0		P	I	P				X	.	X	X	
23	1	0	5	2		-	2	0		P	I	P			-	X	X	.	X			C	G				S	U	P	P	L	Y					V	D	C	
24	1	1	0	0		-	2	8		S	U	P			-	X	X	.	X		1	1	1	0		T	M		B	I	A	S				X	.	X	X	
25																																	33	34	35	36	37	38	39	40
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32								

CRT DISPLAY
FORMAT H
FIGURE 1H

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1		+	X		T	R	A	N	S							X	X		+	R	O	L	L			M	A	N		R	O	T				X	X	
2	0	2		-	X		T	R	A	N	S							X	X		-	R	O	L	L			M	A	N		R	O	T				X	X	
3	0	3		+	Y		T	R	A	N	S							X	X		+	P	I	T	C	H		M	A	N		R	O	T				X	X	
4	0	4		-	Y		T	R	A	N	S							X	X		-	P	I	T	C	H		M	A	N		R	O	T				X	X	
5	0	5		+	Z		T	R	A	N	S							X	X		+	Y	A	W				M	A	N		R	O	T				X	X	
6	0	6		-	Z		T	R	A	N	S							X	X		-	Y	A	W				M	A	N		R	O	T				X	X	
7	0	7																			+	R	O	L	L			M	I	N		I	M	P				X	X	
8	0	8																			-	R	O	L	L			M	I	N		I	M	P				X	X	
9	0	9																			+	P	I	T	C	H		M	I	N		I	M	P				X	X	
10	1	0																			-	P	I	T	C	H		M	I	N		I	M	P				X	X	
11	1	1																			+	Y	A	W				M	I	N		I	M	P				X	X	
12	1	2																			-	Y	A	W				M	I	N		I	M	P				X	X	
13	1	3																			S	H	A	F	T						T	R	U	N						
14	1	4		C	D	U		A	N	G	L	E	S							X	X	X	.	X	X					X	X	X	.	X	X		D	E	G	
15	1	5		C	D	U		D	A	C		O	U	T								X	.	X	X							X	.	X	X		V	R	M	S
16	1	6		C	D	U		F	I	N	E		E	R								X	.	X	X							X	.	X	X		V	R	M	S
17	1	7		S	X	T		S	E	R	V	O		E	R							X	.	X	X							X	.	X	X		V	R	M	S
18	1	8		S	X	T		T	A	C	H		O	U	T							X	.	X	X							X	.	X	X		V	R	M	S
19	1	9		S	X	T		M	O	T		C	O	N	T							X	.	X	X							X	.	X	X		V	R	M	S
20	2	0		S	C	T		T	A	C	H		O	U	T							X	.	X	X							X	.	X	X		V	R	M	S
21	2	1		O	P	T		S	W	I	T	C	H			X	X	X			I	G	N		O	C	D	U		F	A	I	L					X	X	
22	2	2		O	P	T		Z	E	R	O	I	N	G				X	X																					
23	2	3		Z	E	R	O		O	C	D	U	S					X	X																					
24	2	4		O	P	T		E	R	R		C	T	R				X	X																					
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT J
FIGURE 1 J

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1			I	S	S		M	E	A	S					X	/	O	G					Y	/	I	G				Z	/	M	G					
2	0	2		P	I	P	A		C	T	R						X	X	X	X	X				X	X	X	X	X		X	X	X	X	X					
3	0	3		P	I	P	A		S	G		ϕ						X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
4	0	4		T	O	R		M	O	T		C	U	R				.	X	X	X					.	X	X	X			.	X	X	X		A	M	P	S
5	0	5		S	E	R	V	O		E	R		ϕ					X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
6	0	6		S	E	R	V	O		E	R		Q					X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
7	0	7		1	X		R	S	V	R		S	I	N				X	X	.	X					X	X	.	X			X	X	.	X		V	R	M	S
8	0	8		1	X		R	S	V	R		C	O	S				X	X	.	X					X	X	.	X			X	X	.	X		V	R	M	S
9	0	9		C	D	U		C	R	S		E	R	R				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
10	1	0		C	D	U		F	I	N	E		E	R				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
11	1	1		A	N	G									.	X	X	X	X	X			.	X	X	X	X	X			.	X	X	X	X	X		R	A	D
12	1	2		V	S	E		D	R	I	F	T		X	X	X	.	X	X			X	X	X	.	X	X			X	X	X	.	X	X		M	E	R	U
13	1	3			I	S	S		M	E	A	S						X	/	O	G					Y	/	I	G				Z	/	M	G				
14	1	4		C	D	U		A	N	G	L	E	S			X	X	X	.	X	X			X	X	X	.	X	X			X	X	X	.	X	X			
15	1	5		G	I	M	B		A	N	G	L	E	S				X	X	X						X	X	X				X	X	X				D	E	G
16	1	6		D	A	C		A	T	T		E	R	R				X	X	.	X					X	X	.	X			X	X	.	X			D	E	G
17	1	7		D	A	C		T	O		I	U						X	.	X	X					X	.	X	X			X	.	X	X			V	D	C
18	1	8		B	M	A	G										X	X	X	X	X				X	X	X	X	X			X	X	X	X	X				
19	1	9		I	M	U		O	P	E	R	A	T	E				X	X		B	M	A	G		C	T	R		A	B	L						X	X	
20	2	0		I	M	U		C	A	G	E							X	X		I	S	S		T	R	N	O	N		R	Q	S	T				X	X	
21	2	1		C	O	R	S	E		A	L	I	G	N				X	X		I	S	S		T	R	N	O	N		C	O	M	P				X	X	
22	2	2		Z	E	R	O		I	C	D	U	S					X	X		N	O		A	T	T	I	T	U	D	E							X	X	
23	2	3		I	M	U		E	R	R		C	T	R				X	X		T	E	M	P		I	N		L	I	M	I	T					X	X	
24	2	4		I	N	I	T		I	S	S							X	X		A	B	L		C	M	C		S	B	Y							X	X	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT K
FIGURE 1K

SCOPE SPACING CHART FOR PAGE DISPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
AA																																								
1																																								
2																																								
3																																								
4																																								
5																																								
6																																								
7																																								
8																																								
9																																								
10																																								
11																																								
12																																								
13	1	3																																						
14	1	4																																						
15	1	5																																						
16	1	6																																						
17	1	7																																						
18	1	8		T	V	C		E	N	A	B	L	E					X	X		L	I	F	T	O	F	F											X	X	
19	1	9		U	L	L	A	G	E									X	X		G	U	I	D		R	E	F		R	E	L						X	X	
20	2	0		S	A	T		T	A	K	O	V	R					X	X		G	/	N		C	O	N	T	R	O	L							X	X	
21	2	1		S	A	T		I	N	J		S	E	Q				X	X		S	/	C		C	T	L		S	A	T	U	R	N				X	X	
22	2	2		S	A	T		C	U	T	O	F	F					X	X		S	I	V	B		S	E	P	/	A	B	T						X	X	
23	2	3		S	P	S		R	E	A	D	Y						X	X		S	M		S	E	P	A	R	A	T	E							X	X	
24	2	4		L	M		A	T	T	A	C	H	E	D				X	X		E	N	G	I	N	E		O	N									X	X	
25																																								

CRT DISPLAY
FORMAT L
FIGURE 1L

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1		C	G		T	E	M	P		L	O	C				D	E	G		F			C	G				T	E	M	P					D	E	G		F
2	8	2	5	3		P	S	A			1							X	X	X		8	2	0	0		N	A	V	B	S	E					X	X	X	
3	8	2	5	4		P	S	A			2							X	X	X		8	2	6	5		X		P	I	P	A					X	X	X	
4	8	2	5	5		P	S	A			3							X	X	X		8	2	6	6		Y		P	I	P	A					X	X	X	
5	8	2	5	9		C	M	C			1							X	X	X		8	2	6	7		Z		P	I	P	A					X	X	X	
6	8	2	6	0		C	M	C			2							X	X	X		8	2	7	7		S	X	T		L	1					X	X	X	
7	8	2	6	1		C	M	C			3							X	X	X		8	2	7	8		S	X	T		L	2					X	X	X	
8	8	2	7	1		C	D	U			1							X	X	X		8	2	7	9		S	X	T		L	3					X	X	X	
9	8	2	7	2		C	D	U			2							X	X	X																				
10	8	2	7	3		C	D	U			3							X	X	X																				
11																																								
12																																								
13																																								
14																																								
15																																								
16																																								
17																																								
18																																								
19																																								
20																																								
21																																								
22																																								
23																																								
24																																								
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT M
FIGURE 1 M

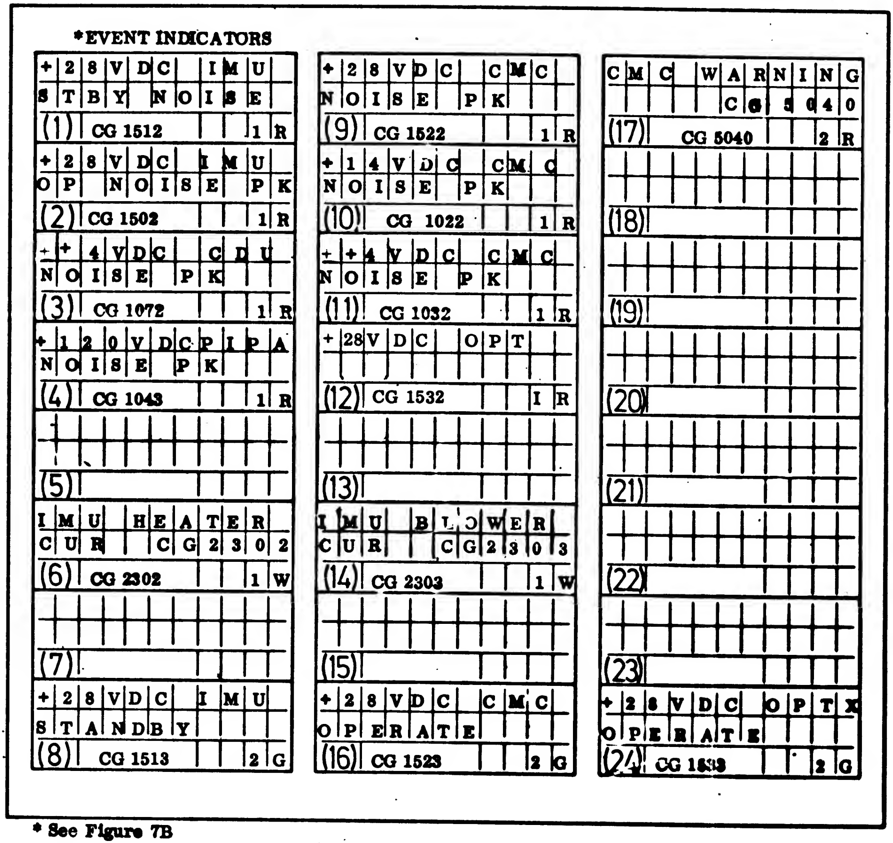
3.5 METER DISPLAYS. The use of Meter Modules 004A2A3, 004A2A4, 004A3A6, 004A3A7, 004A3A8, 004A3A9, 0014A1A3, and 014A1A4 shall be determined by the testing activity.

3.6 EVENT INDICATOR DISPLAYS. The event indicator display format assignment for each Spacecraft shall be as specified in Table V.

TABLE V

EVENT INDICATOR
DISPLAYS

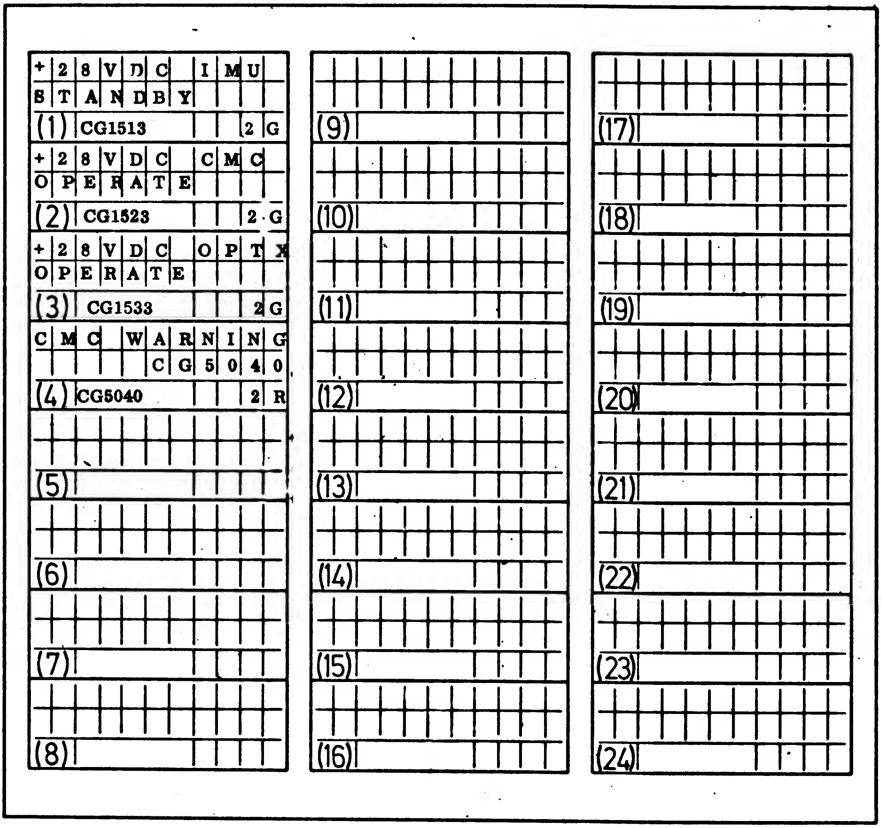
SPACE-CRAFT	CONSOLE/PANEL				
	004A3		014A1		004A4
	Event	Module	Event	Module	Event Module
	A 4 Figure	A 5 Figure	A 1 Figure	A 2 Figure	
2TV1-M		3B		3B	
101-K	3C	3A	3C	3A	
102-N	3C	3A		3A	
103-N	3C	3A		3A	
104-N	3C	3A		3A	


*EVENT INDICATORS
+28VDC IMU STBY NOISE (1) CG 1512 1 R
+28VDC IMU OP NOISE PK (2) CG 1502 1 R
+4VDC CDU NOISE PK (3) CG 1072 1 R
+120VDC PIPA NOISE PK (4) CG 1043 1 R
(5)
IMU HEATER CUR CG2302 (6) CG 2302 1 W
(7)
+28VDC IMU STANDBY (8) CG 1513 2 G
+28VDC CMC NOISE PK (9) CG 1522 1 R
+14VDC CMC NOISE PK (10) CG 1022 1 R
+4VDC CMC NOISE PK (11) CG 1032 1 R
+28VDC OPT (12) CG 1532 1 R
(13)
IMU BLOWER CUR CG2303 (14) CG 2303 1 W
(15)
+28VDC CMC OPERATE (16) CG 1523 2 G
CMC WARNING CG5040 (17) CG 5040 2 R
(18)
(19)
(20)
(21)
(22)
(23)
+28VDC OPTX OPERATE (24) CG 1533 2 G

* See Figure 7B

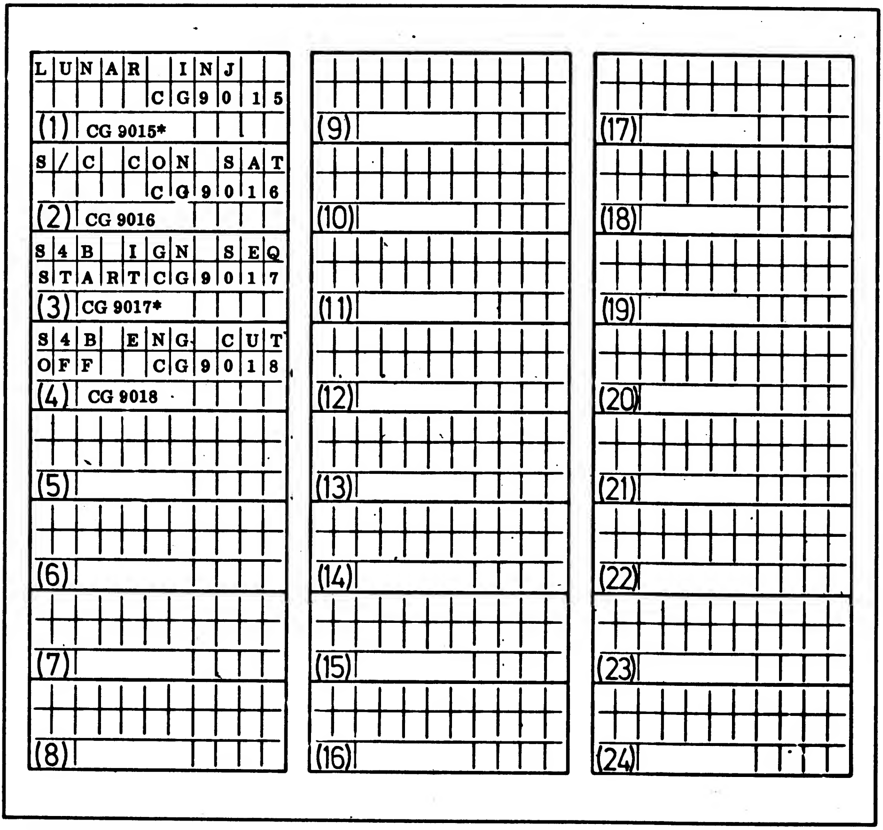
EVENT INDICATOR DISPLAY A

FIGURE 3 A



EVENT INDICATOR DISPLAY B

FIGURE 3B



* Not Applicable S/C 101-K.

EVENT INDICATOR DISPLAY C

FIGURE 3C

3.7 EVENT RECORDER SIGNAL ARRANGEMENT. The signals recorded on the 32 channel Event Recorder, Panel/Module Number 004A2A2, shall be arranged as specified in Table VI.

TABLE VI.

EVENT RECORDER SIGNAL ARRANGEMENT

SPACECRAFT	SIGNAL ARRANGEMENT FIGURE
2TV1-M	4B
101-K	4C
102-N	4A
103-N	4A
104-N	4A

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			
2	CG1032	1	+4 VDC CMC NOISE PK CG1032
3	CG1072	1	+4 VDC CDU NOISE PK CG1072
4	CG1532	1	+28 VDC OPTX NOISE PK CG1532
5	CG2302	1	IMU HEATER CUR CG2302
6			
7			
8			
9	CG1523	2	+28 VDC CMC OPER CG1523
10	CG1513	2	+28 VDC IMU STBY CG1513
11	CG1043	1	+120 VDC PIPA NOISE PK CG1043
12			
13	CG2303	1	IMU BLOWER CUR CG2303
14			
15			
16			
17	CG1522	1	+28 VDC CMC NOISE PK CG1522
18	CG1512	1	+28 VDC IMU STBY NOISE CG1512
19			
20	CG5040	2	CMC WARNING CG5040
21			
22			
23			
24			
25	CG1022	1	+14 VDC CMC NOISE PK CG1022
26	CG1502	1	+28 VDC IMU OP NOISE PK CG1502
27	CG1533	2	+28 VDC OPTX OPER CG1533
28	CG9015 *		LUNAR INJECT CG9015
29	CG9016 *		S/C CONT OF SATURN CG9016
30	CG9017 *		SIVB IGN SEQ START CG9017
31	CG9018		SIVB ENGINE CUTOFF CG9018
32			
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

* DISPLAY IF AVAILABLE

EVENT RECORDER

SIGNAL ARRANGEMENT

FIGURE 4A

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			
2	CG1513	2	+28 VDC IMU STANDBY
3	CG1523	2	+28 VDC CMC OPERATE
4	CG1538	2	+28 VDC OPTX OPERATE
5	CG5040	2	CMC WARNING
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

EVENT RECORDER

SIGNAL ARRANGEMENT

FIGURE 4B

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			TIMING
2	CG 1523	2	+28 VDC CMC OPER CG 1523
3	CG 1513	2	+28 VDC IMU STBY CG 1513
4	CG 1533	2	+28 VDC OPTX OPER CG 1533
5	CG 1522	1	+28 VDC CMC NOISE CG 1522
6	CG 1022	1	+14 VDC CMC NOISE CG 1022
7	CG 1032	1	+4 VDC CMC NOISE CG 1032
8	CG 1512	1	+28 VDC STBY NOISE CG 1512
9	CG 1502	1	+28 VDC OPER NOISE CG 1502
10	CG 1072	1	+4 VDC CDU NOISE CG 1072
11	CG 1043	1	+120V PIPA NOISE CG 1043
12	CG 1532	1	+28 VDC OPTX NOISE CG 1532
13	CG 2302	1	HEATER CURRENT CG 2302
14	CG 2303	1	BLOWER CURRENT CG 2303
15	CG 5040	2	CMC WARNING CG 5040
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29	CG 9016		S/C CONT OF SATURN CG 9016
30			
31	CG 9018		SIVB ENGINE CUTOFF CG 9018
32			TIMING
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

EVENT RECORDER
SIGNAL ARRANGEMENT
FIGURE 4C

3.8 ANALOG RECORDER SIGNAL ARRANGEMENT. The signals recorded on the Analog Recorder shall be arranged as specified in Table VII.

TABLE VII

ANALOG RECORDER SIGNAL ARRANGEMENT

SPACECRAFT	CONSOLE/ PANEL		
	004A1		004A3
	Analog Module		Analog Module
	A 2	A 3	A 02
2TV1-M	Fig 5D	Fig. 5E	
101-K	Fig. 5G	Fig. 5F	Fig. 5H
102-N	Fig. 5A	Fig. 5B	Fig. 5C
103-N	Fig. 5A	Fig. 5B	Fig. 5C
104-N	Fig. 5A	Fig. 5B	Fig. 5C

CHANNEL

1	2	3
SXT SHAFT SERVO ERROR **IN PH CG 3117**	**SXT TRUN SERVO ERROR** **IN PH CG 3118**	**SHAFT CDU FINE ERROR** **RMS CG 3021**
Measurement No. CG 3117 Link No. 1	Measurement No. CG 3118 Link No. 1	Measurement No. CG 3021 Link No. 1

4	5	6
TRUN CDU FINE ERROR **RMS CG 3011**	**SXT SHAFT TACH OUTPUT** **IN PH CG 3140**	**SXT TRUN TACH OUTPUT** **IN PH CG 3150**
Measurement No. CG 3011 Link No. 1	Measurement No. CG 3140 Link No. 1	Measurement No. CG 3150 Link No. 1

7	8
SHAFT CDU DAC OUTPUT **CG 3721**	**TRUN CDU DAC OUTPUT** **CG 3722**
Measurement No. CG 3721 Link No. 2	Measurement No. CG 3722 Link No. 2

8 CHANNEL ANALOG RECORDER
SIGNAL ARRANGEMENT A

FIGURE 5 A

CHANNEL

1	2	3
HI RATE CHANNEL	+14V CMC SUPPLY DC LEVEL CG 1020	+4V CMC SUPPLY DC LEVEL CG 1030
Measurement No. Link No.	Measurement No. CG 1020 Link No. 1	Measurement No. CG 1030 Link No. 1

4	5	6
PITCH ATT ERR - CDU DAC OUT IN PH CG 2219	YAW ATT ERR - CDU DAC OUT IN PH CG 2249	ROLL ATT ERR - CDU DAC OUT IN PH CG 2279
Measurement No. CG 2219 Link No. 1	Measurement No. CG 2249 Link No. 1	Measurement No. CG 2279 Link No. 1

7	8
PIPA TEMPERATURE CG 2300	[illegible] TEMPERATURE CG 2301
Measurement No. CG 2300 Link No. 2	Measurement No. CG 2301 Link No.

8 CHANNEL ANALOG RECORDER
SIGNAL ARRANGEMENT B

FIGURE 5 B

SWITCH POSITION

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	CG 2120	1	IG TORQUE MOT CURRENT CG 2120
1	2	CG 2177	2	OG SERVO ERROR IN PH CG 2177
1	3	CG 3145	1	SXT SHAFT MOT CONT WD CG 3145
1	4			
2	1	CG 6020	1	PIPA CAL MOD TEMP CG 6020
2	2	CG 2180	1	OG TORQUE MOT CURRENT CG 2180
2	3	CG 2147	2	MG SERVO ERROR IN PH CG 2147
2	4			
3	1	CG 2117	2	IG SERVO ERR IN PH CG 2117
3	2	CG 3155	1	SXT TRUN MOT CONT WD CG 3155
3	3	CG 2150	1	MG TORQUE MOT CURRENT CG 2150
3	4			
4	1	CG 2112	2	IG 1 X RSVR OUT SIN CG 2112
4	2	CG 2280	1	OG CDU FINE ERROR CG 2280
4	3	CG 2143	2	MG 1X RSVR OUT COS CG 2143
4	4			
5	1	CG 2113	2	IG 1X RSVR OUT COS CG 2113
5	2	CG 2172	2	OG 1X RSVR OUT SIN CG 2172
5	3	CG 2250	1	MG CDU FINE ERROR CG 2250
5	4			
6	1	CG 2220	1	IG CDU FINE ERROR CG 2220
6	2	CG 2173	2	OG 1X RSVR OUT COS CG 2173
6	3	CG 2142	2	MG 1X RSVR OUT SIN CG 2142
6	4			
7	1	CG 4300	1	CMC TEMP CG 4300
7	2	CG 1520	1	+28V CGC OPER CG 1520
7	3	CG 3170	2	SCT TRUN TACH OUT CG 3170
7	4			
8	1	CG 1201	2	IMU 28 V 1 PCT CG 1201
8	2	CG 1040	2	+120V PIPA SUP CG 1040
8	3	CG 3160	2	SCT SHAFT TACH OUT CG 3160
8	4			
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

32 CHANNEL ANALOG RECORDER

SIGNAL ARRANGEMENT C

FIGURE 5 C

1	2	3
IG 1X RSVR OUT SIN CG2112	IG 1X RSVR OUT COS CG2113	MG 1X RSVR OUT SIN CG2142
Measurement No. CG2112 Link No. 2	Measurement No. CG2113 Link No. 2	Measurement No. CG2142 Link No. 2

4	5	6
MG 1X RSVR OUT COS CG2143	OG 1X RSVR OUT SIN CG2172	OG 1X RSVR OUT COS CG2173
Measurement No. CG2143 Link No. 2	Measurement No. CG2172 Link No. 2	Measurement No. CG2173 Link No. 2

7	8
3.2KC 28V SUPPLY CG1331	IMU 28V 1PCT CG1201
Measurement No. CG1331 Link No. 2	Measurement No. CG1201 Link No. 2

8 CHANNEL ANALOG RECORDER

SIGNAL ARRANGEMENT D

FIGURE 5D

1	2	3
HI RATE CHANNEL	IG SERVO ERR IN PH CG2117	MG SERVO ERR IN PH CG2147
Measurement No. Link No.	Measurement No. CG2117 Link No. 2	Measurement No. CG2147 Link No. 2

4	5	6
OG SERVO ERR IN PH CG2177	PIPA TEMPERATURE CG2300	+120V PIPA SUPPLY CG1040
Measurement No. CG2177 Link No.	Measurement No. CG2300 Link No. 2	Measurement No. CG1040 Link No. 2

7	8
SHAFT CDU DAC OUTPUT CG3721	TRUN CDU DAC OUTPUT CG3722
Measurement No. CG3721 Link No. 2	Measurement No. CG3722 Link No. 2

8 CHANNEL ANALOG RECORDER

SIGNAL ARRANGEMENT E

FIGURE 5E

1	2	3
IGA CDU FINE ERR CG 2220	IGA CDU COARSE ERR CG 2221	MGA CDU FINE ERR CG 2250
Measurement No. CG 2220 Link No. 1	Measurement No. CG 2221 Link No. 1	Measurement No. CG 2250 Link No. 1

4	5	6
MGA CDU COARSE ERR CG 2251	OGA CDU FINE ERR CG 2280	OGA CDU COARSE ERR CG 2281
Measurement No. CG 2251 Link No. 1	Measurement No. CG 2280 Link No. 1	Measurement No. CG 2281 Link No. 1

7	8
3.2KC 28V SUPPLY CG 1331	HI RATE
Measurement No. CG 1331 Link No. 2	Measurement No. Link No.

8 CHANNEL ANALOG RECORDER
SIGNAL ARRANGEMENT F
FIGURE 5F

1	2	3
IG SERVO ERROR IN PHASE CG 2117	IG TORQUE MTR CURRENT CG 2120	MG SERVO ERROR IN PHASE CG 2147
Measurement No. CG 2117 Link No. 2	Measurement No. CG 2120 Link No. 1	Measurement No. CG 2147 Link No. 2

4	5	6
MG TORQUE MTR CURRENT CG 2150	OG SERVO ERROR IN PHASE CG 2177	OG TORQUE MTR CURRENT CG 2180
Measurement No. CG 2150 Link No. 1	Measurement No. CG 2177 Link No. 2	Measurement No. CG 2180 Link No. 1

7	8
PIPA TEMP CG 2300	IRIG TEMP CG 2301
Measurement No. CG 2300 Link No. 2	Measurement No. CG 2301 Link No. 1

8 CHANNEL ANALOG RECORDER
SIGNAL ARRANGEMENT G
FIGURE 5G

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	CG 3011	1	TRUN CDU FINE ERR CG 3011
1	2	CG 1020	1	14V CMC SUPPLY CG 1020
1	3	CG 2279	1	ROLL ATT ERROR CDU DAC CG 2279
1	4			
2	1	CG 3118	1	SXT TRUN SERVO ERR INPH CG 3118
2	2	CG 1070	1	+4V CDU SUPPLY CG 1070
2	3	CG 2219	1	PITCH ATT ERR CDU DAC CG 2219
2	4			
3	1	CG 3150	1	SXT TRUN TACH OUTPUT CG 3150
3	2	CG 3021	2	SHAFT CDU FINE ERR CG 3021
3	3	CG 2249	1	YAW ATT ERROR CDU DAC CG 2249
3	4			
4	1	CG 3155	1	SXT TRUN MTR CONTROL CG 3155
4	2	CG 3117	1	SXT SHFT SERVO ERR IN PH CG 3117
4	3	CG 1201	2	IMU 28V .8KC 1% CG 1201
4	4			
5	1	CG 3170	2	SCT TRUN TACH OUTPUT CG 3170
5	2	CG 3140	2	SXT SHAFT TACH OUTPUT CG 3140
5	3	CG 1211	1	OPT 28V .8KC 1% CG 1211
5	4			
6	1	CG 3722	2	TRUN CDE DAC OUTPUT CG 3722
6	2	CG 3145	1	SXT SHAFT MTR CONTROL CG 3145
6	3	CG 2001	2	X PIPA SG OUT CG 2001
6	4			
7	1	CG 1100	1	-28VDC SUPPLY CG 1100
7	2	CG 3160	2	SCT SHAFT TACH OUTPUT CG 3160
7	3	CG 2021	2	Y PIPA SG OUT CG 2021
7	4			
8	1	CG 1110	2	2.5VDC TM BIAS CG 1110
8	2	CG 3721	2	SHAFT CDU DAC OUTPUT CG 3721
8	3	CG 2041	2	Z PIPA SG OUT INPH CG 2041
8	4			
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

32 CHANNEL ANALOG RECORDER
SIGNAL ARRANGEMENT H
FIGURE 5H

3.9 R-START SIGNAL ARRANGEMENT. The R-START signal arrangement for each Spacecraft shall be as specified in Table VIII.

TABLE VIII

R-START SIGNAL ARRANGEMENT

SPACECRAFT	CONSOLE/PANEL	
	004A2	004A4
	Module A6	Module A5
2TV1-M	Figure 6B	Figure 6A
101-K	Figure 6D	Figure 6C
102-N	Figure 6B	Figure 6A
103-N	Figure 6B	Figure 6A
104-N	Figure 6B	Figure 6A

R-START 144				R-START 145			
			G&N ERROR RESET KZ0014				
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START 146				R-START 147			
	Special K-Start Verify KZ0016	Special K-Start Load Verify KZ0015		PIPA Reference Commands KG7009	X PIPA Output Commands KG7010	Y PIPA Output Commands KG7011	Z PIPA Output Commands KG7012
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START SIGNAL ARRANGEMENT A

FIGURE 6A

R-START 152				R-START 153			
	GMC TIME X MISSION KZ 0013	CMC TIME CORRECTION & VERIF. KZ0012	CMC CLOCK INITIAL KZ 0011	CMC DISPLAY PROGRAM DSKY G&N 662A		CMC DISPLAY RECORD G&N 624A	
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START 154*				R-START 155			
	CMC 14 VOLT STIMULI DAC 8 KG 7021	CMC 4 VOLT STIMULI DAC 7 KC 7020	CMC MARGIN TEST ENABLE KG 7019	IGA STEP COMMAND KG 7013	MGA STEP COMMAND KG 7014	OGA STEP COMMAND KG 7015	
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

* Not applicable to 2TV1-M

R-START SIGNAL ARRANGEMENT B

FIGURE 6 B

R-START 144				R-START 145			
			G&N ERROR RESET G&N 671 KZ 0024	CMC DISPLAY PROGRAM DSKY G&N 622 KZ 0025		CMC DISPLAY RECORD G&N 224 KZ 0033	
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START 146				R-START 147			
	K-START VERIFY G&N 632 KZ 0031	K-START LOAD-VERIFY G&N 632 KZ 0030		PIPA REFERENCE COMMANDS G&N 181 KG 7009	X PIPA OUTPUT COMMANDS G&N 181 KG 7010	Y PIPA OUTPUT COMMANDS G&N 181 KG 7011	Z PIPA OUTPUT COMMANDS G&N 181 KG 7012
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START ARRANGEMENT C

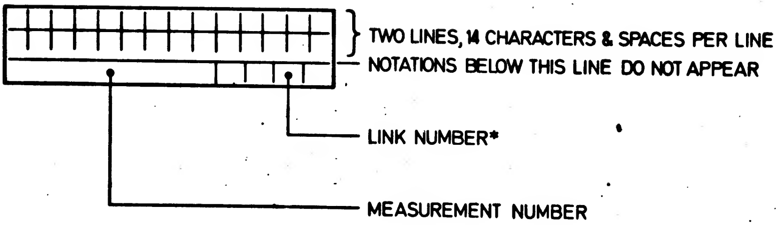
FIGURE 6C

R-START 152				R-START 153			
(D)	CMC TIME XMISSION G&N 603 KZ 0011 (C)	CMC TIME CORRECTION & VERIF. G&N 602 KZ 0010 (B)	CMC CLOCK INITIAL G&N 601 KZ 0009 (A)	(D)	(C)	LIFT OFF KV 7044 (B)	GUID RELEASE KV 7043 (A)

R-START 154				R-START 155			
(D)	CMC 14 VOLT STIMULI DAC 8 KG 7021 (C)	CMC 4 VOLT STIMULI DAC 7 KG 7020 (B)	CMC MARGIN TEST ENABLE KG 7019 (A)	IGA STEP COMMAND G&N 181 KG 7013 (D)	MGA STEP COMMAND G&N 181 KG 7014 (C)	OGA STEP COMMAND G&N 181 KG 7015 (B)	(A)

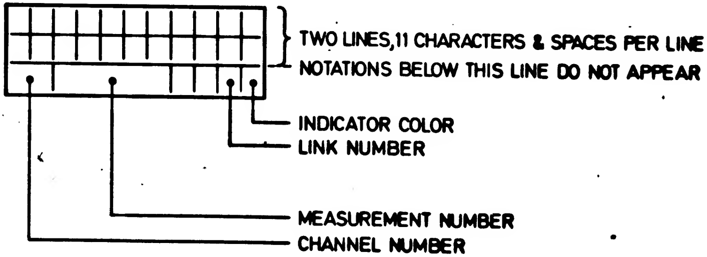
R-START ARRANGEMENT D

FIGURE 6D


TWO LINES, 14 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
LINK NUMBER*
MEASUREMENT NUMBER

7 A. - METER IDENTIFICATION INSERT

* LINK 1 = Carry on, LINK 2 - Airborne


TWO LINES, 11 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
INDICATOR COLOR
LINK NUMBER
MEASUREMENT NUMBER
CHANNEL NUMBER

7 B. - EVENT INDICATOR DISPLAY FORMAT

FIGURE 7

3.10 C-START. - The C-START (C156) arrangement for each spacecraft shall be as specified in Table IX.

TABLE IX

CODE NO.	SUB-PROGRAM	C-START ENTRY
31	G&N 631	00000XXX
20	G&N 641	XX000000
*	G&N 601 CODES 90, 91, 70, 80, 71	XXXXXXXX

* Applicable 101-K only.

4. QUALITY ASSURANCE PROVISIONS

4.1 INSPECTION. The requirements specified in Section 3 shall be verified by visual inspection.

5. PREPARATION FOR DELIVERY. This section is not applicable to this specification.

6. NOTES.

6.1 VARIATIONS TO SIGNAL ARRANGEMENT. Signal arrangements within a display module or assembly may be varied, but the signals shall be retained by the original module or assembly specified. The signal arrangement for the CRT display (3.4) shall be restricted to variations within the half page specified.

6.2 SPACECRAFT LOCATION. The letter following the spacecraft number indicates the location of the spacecraft. Locations are as follows:

	Applicable At
-G	Grumman Aircraft
-K	KSC
-M	MSC
-N	NAA
No letter	Applicable at all locations

6.3 NOMENCLATURE VARIANCE. Nomenclature may be varied by the user in Sections 3.5 through 3.8, however, the measurement number must be a portion of the nomenclature.

APOLLO G&N Specification
ND1002321 REV –
Original Issue Date:
Release Authority: TDRR 31344
Class A Release
CODE IDENT NO. 99974

G&N PROGRAMMING REQUIREMENTS
(DISPLAYS & CONTROLS)
FOR
ACCEPTANCE CHECKOUT EQUIPMENT
(BLOCK II)

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
					NASA

This specification consists of page 1 to 33 inclusive.

APPROVALS	NASA/MSC				AC

1. SCOPE

1.1 PURPOSE. This specification establishes the G&N programming requirements for signal arrangements displays, and limits during post-installation checkout of a Spacecraft using Acceptance Checkout Equipment (ACE). (See 6.1)

2. APPLICABLE DOCUMENTS

2.1 EFFECTIVE ISSUES. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, Military Standards and Specifications shall be that issue in effect on the date of request for proposal or invitation to bid.

SPECIFICATIONS

APOLLO G&N

ND1002319	ACE-S/C Computer Subprogram Specification for APOLLO CM and LM G&N Testing

North American Aviation

MA0201	NAA Acceptance Checkout Equipment - SC Programming Requirements

(Copies of specifications, standards, drawings, bulletins, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 CONFLICTING REQUIREMENTS. In the event of a conflict between requirements, the following order of precedence shall apply.

a. The contract.
b. This specification.
c. Documents listed in this specification.

3. REQUIREMENTS

3.1 G&N SPACECRAFT SUBPROGRAMS. The subprograms contained in Specification ND1002319 shall be used for the applicable Spacecraft configuration as specified in Table I.

TABLE I
SUBPROGRAMS

SPACECRAFT	SUBPROGRAMS	
	AC ELECTRONICS Identification Number	ASPO Identification Number
102	G&N 601	MIT-U005-0
	602	U006-0
	603	U007-0
	221	D012-0
	622	D008-0
	224	D013-0
	631	C003-0
	641 (or equiv. ADAP program)	C004-0
	652	D010-0
	671	D011-0
	G&N 181 (or equiv. ADAP program)	MIT-U104-0

3.2 SIGNAL BLINK LIMITS. The following signal blink limits shall apply to all G&N Spacecraft.

a. The following signals shall have blink limits equal to tolerances specified in the applicable NAA Acceptance Checkout Equipment-SC Programming Requirements process Specification MA0201.

CG 1020
CG 1030
CG 1040
CG 1051
CG 1052
CG 1070
CG 1100
CG 1110
CG 1201
CG 1202
CG 1203
CG 1211
CG 1212
CG 1331
CG 1336
CG 1500
CG 1510
CG 1520
CG 1530

b. The following signals shall have blink limits of ±4095:

CG 1021
CG 1031
CG 1042
CG 1053
CG 1071
CG 1207
CG 1220
CG 1501
CG 1511
CG 1521
CG 1531
CG 2001
CG 2021
CG 2041
CG 2108
CG 2117
CG 2120
CG 2138
CG 2147
CG 2150
CG 2168
CG 2177
CG 2180
CG 2219
CG 2220
CG 2249
CG 2250
CG 2251
CG 2279
CG 2280
CG 2281
CG 2300
CG 2301
CG 3011
CG 3021
CG 3117
CG 3118
CG 3140
CG 3145
CG 3150
CG 3155
CG 3160
CG 3170
CG 3721
CG 3722
CG 4300
CG 6020
CG 6021

3.3 HIGH RATE MEASUREMENTS. The C START Panel shall program the signals specified in Table II, in response to the entry selected on the C START panel, to the channel specified on the GSE Carryon G&N Signal Conditioning and Switching Matrix Unit, C14-213, (SCSMU).

TABLE II

HIG[illegible]ATE MEASUREMENTS

SIGNAL PROGRAMMED MEAS NO.	C-START ENTRY ON C-START PANEL	C14-213 SCSMU CHANNEL NO.
CG 2117	2032000000	01
CG 2120	2027000000	02
CG 2147	2028000000	03
CG 2108	2029000000	04
CG 2138	2030000000	05
CG 2150	2031000000	06
CG 2177	2026000000	07
CG 2180	2005000000	08
CG 2219	2006000000	10
CG 2249	2007000000	11
CG 2279	2009000000	12
CG 3117	2010000000	13
CG 3118	2021000000	14
CG 3140	2025000000	15
CG 2168	2023000000	17
CG 2251	2001000000	18
CG 2281	2002000000	19
CG 2221	2003000000	20
CG 2250	2019000000	22
CG 2220	2020000000	23
CG 3150	2008000000	28
CG 3011	2022000000	29
CG 3021	2024000000	30
CG 3155	2014000000	34
CG 3160	2015000000	35
CG 3170	2016000000	36
CG 2280	2017000000	37
CG 3145	2012000000	40

3.4 CRT DISPLAYS. The CRT screen on the CRT module shall display information for each Spacecraft in accordance with Table III.

TABLE III

SPACECRAFT/CRT DISPLAY

SPACE-CRAFT	CRT DISPLAY FORMAT FIGURE
101	
102	1A, 1B, 1C, 1D, 1E
103	

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1											P	H	A	S	E			D	I	F	F	E	R	E	N	C	E													
2	1	2	0	7		I	M	U		1	/	5					X	X	X		1	2	2	0		O	P	T	/	I	M	U					X	X	X	
3	0	3			Q	U	A	D	R	A	T	U	R	E					O	G						I	G						M	G						
4	0	4		S	E	R	V	O		E	R	R						X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
5												N	O	I	S	E		M	E	A	S	U	R	E	M	E	N	T	S		V	R	M	S						
6	1	0	2	1		+	1	4		C	M	C				X	.	X	X		1	5	0	1		+	2	8		O	P					X	.	X	X	
7	1	0	3	1		+		4		C	M	C				X	.	X	X		1	5	1	1		+	2	8	S	T	B	Y				X	.	X	X	
8	1	0	4	2		1	2	0		P	I	P				X	.	X	X		1	5	2	1		+	2	8		C	M	C				X	.	X	X	
9	1	0	5	3		+	2	0		P	I	P				X	.	X	X		1	5	3	1		+	2	8		O	P	T				X	.	X	X	
10	1	0	7	1		+		4		C	D	U				X	.	X	X																					
11																																								
12	1	1	1	0		T	M		B	I	A	S				X	.	X	X		2	3	0	3		B	I	R		C	U	R				X	X	.	X	
13	1	0	2	0		+	1	4		C	M	C				X	X	.	X		1	2	0	2		I	M	U		5	%	-				X	X	.	X	
14	1	0	3	0		+		4		C	M	C				X	.	X	X		1	2	0	3		I	M	U		5	%	0				X	X	.	X	
15	1	0	4	0		1	2	0		P	I	P					X	X	X		1	2	1	1		O	P	T		1	%	0				X	X	.	X	
16	1	0	5	1		+	2	0		P	I	P				X	X	.	X		1	2	1	2		O	P	T		5	%	-				X	X	.	X	
17	1	0	5	2		-	2	0		P	I	P				X	X	.	X		1	3	3	1		3	.	2	K	2	8	V				X	X	.	X	
18	1	0	7	0		+		4		C	D	U				X	.	X	X		1	3	3	6		3	.	2	/	C	M	C					X	X	X	
19	1	1	0	0		-	2	8		S	U	P				X	X	.	X			C	G					T	E	M	P					D	E	G	F	
20	1	5	0	0		+	2	8		O	P					X	X	.	X		2	3	0	0				P	I	P	A				X	X	X	.	X	
21	1	5	1	0		+	2	8	S	T	B	Y				X	X	.	X		2	3	0	1				I	R	I	G				X	X	X	.	X	
22	1	5	2	0		+	2	8		C	M	C				X	X	.	X		4	3	0	0		C	M	C	T	E	M	P					X	X	X	
23	1	5	3	0		+	2	8		O	P	T				X	X	.	X		6	0	2	0		C	A	L		M	O	D					X	X	X	
24	1	2	0	1		I	M	U		1	%	0				X	X	.	X		6	0	2	1		I	M	U		5	%						X	X	X	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT A

FIGURE 1A

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1			I	S	S		M	E	A	S						O	G	/	X					I	G	/	Y					M	G	/	Z			
2	0	2		C	D	U		A	N	G	L	E	S					X	X	X	.	X	X			X	X	X	.	X	X			X	X	X	.	X	X	
3	0	3		G	I	M	B		A	N	G	L	E	S				X	X	X						X	X	X				X	X	X			D	E	G	
4	0	4		S	E	R	V	O		E	R		φ					X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
5																																								
6	0	6		C	D	U		F	I	N	E		E	R				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
7	0	7		C	D	U		C	R	S			E	R				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
8	0	8		T	O	R		M	O	T		C	U	R				.	X	X	X					.	X	X	X			.	X	X	X		A	M	P	S
9	0	9		P	I	P		S	G		O	U	T	φ				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
10																		R	O	L	L				P	I	T	C	H				Y	A	W					
11	1	1		D	A	C		A	T	T		E	R					X	X	.	X					X	X	.	X			X	X	.	X		D	E	G	
12	1	2		D	A	C		T	O		I	U						X	.	X	X					X	.	X	X			X	.	X	X		V	D	C	
13	1	3		E	N	G	I	N	E		O	N					O	F	F		L	I	F	T	O	F	F										O	F	F	
14	1	4		T	V	C		E	N	A	B	L	E				O	F	F		G	U	I	D	N	C	E		R	E	F		R	L			O	F	F	
15	1	5		U	L	L	A	G	E								O	F	F		S	/	C		C	T	L		S	A	T	U	R	N			O	F	F	
16	1	6		S	M		S	E	P	A	R	A	T	E			O	F	F		S	A	T		T	A	K	O	V	R		A	B	L			O	F	F	
17	1	7		S	P	S		R	E	A	D	Y					O	F	F		S	A	T		I	N	J		S	E	Q		S	T			O	F	F	
18	1	8		G	/	N		C	O	N	T	R	O	L			O	F	F		S	A	T		C	U	T	O	F	F							O	F	F	
19	1	9		+	X		T	R	A	N	S						O	F	F		+	P	I	T	C	H		M	A	N		R	O	T			O	F	F	
20	2	0		-	X		T	R	A	N	S						O	F	F		-	P	I	T	C	H		M	A	N		R	O	T			O	F	F	
21	2	1		+	Y		T	R	A	N	S						O	F	F		+	Y	A	W				M	A	N		R	O	T			O	F	F	
22	2	2		-	Y		T	R	A	N	S						O	F	F		-	Y	A	W				M	A	N		R	O	T			O	F	F	
23	2	3		+	Z		T	R	A	N	S						O	F	F		+	R	O	L	L			M	A	N		R	O	T			O	F	F	
24	2	4		-	Z		T	R	A	N	S						O	F	F		-	R	O	L	L			M	A	N		R	O	T			O	F	F	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT B
FIGURE 1 B

SCOPE SPACING CHART
FOR PAGE DISPLAY

AA																																								
1	S	H	A	F	T		C	D	U		X	X	X	.	X	X		D	E	G		T	R	U	N		C	D	U		X	X	.	X	X	X		D	E	G
2																																								
3	O	P	T		Z	E	R	O	I	N	G						O	F	F		Z	E	R	O		O	P	T		C	D	U	S				O	F	F	
4	O	P	T		S	W	I	T	C	H							X	X	X																					
5	O	P	T		C	D	U		F	A	I	L					O	F	F		I	G	N		O	C	D	U		F	A	I	L				O	F	F	
6	T	R	A	C	K	E	R		F	A	I	L					O	F	F		A	B	L		O	P	T		E	R		C	T	R			O	F	F	
7																																								
8																																								
9																																								
10																																								
11																																								
12																																								
13	S	H	A	F	T		C	D	U		X	X	X	.	X	X		D	E	G		T	R	U	N		C	D	U		X	X	.	X	X	X		D	E	G
14		C	G			S	H	A	F	T		C	D	U								C	G			T	R	U	N		C	D	U							
15	3	0	2	1		F	I	N	E		E	R				X	.	X	X		3	0	1	1		F	I	N	E		E	R				X	.	X	X	
16	3	7	2	1		D	A	C		O	U	T				X	.	X	X		3	7	2	2		D	A	C		O	U	T				X	.	X	X	
17		C	G			S	H	A	F	T		S	X	T		V	R	M	S			C	G			T	R	U	N		S	X	T			V	R	M	S	
18	3	1	1	7		S	R	V	O		E	R				X	.	X	X		3	1	1	8		S	R	V	O		E	R				X	.	X	X	
19	3	1	4	0		T	A	C		O	U	T				X	.	X	X		3	1	5	0		T	A	C		O	U	T				X	.	X	X	
20	3	1	4	5		M	O	T		C	O	N				X	.	X	X		3	1	5	5		M	O	T		C	O	N				X	.	X	X	
21																																								
22		C	G			S	H	A	F	T		S	C	T		V	R	M	S			C	G			T	R	U	N		S	C	T			V	R	M	S	
23	3	1	6	0		T	A	C		O	U	T				X	.	X	X		3	1	7	0		T	A	C		O	U	T				X	.	X	X	
24																																								
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT C
FIGURE 1 C

SCOPE SPACING CHART
FOR PAGE DISPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
AA																																								
1																																								
2																																								
3																																								
4																																								
5																																								
6																																								
7	B	M	A	G	X										X	X	X	X	X		+	P	I	T	C	H		M	I	N		I	M	P			O	F	F	
8	B	M	A	G	Y										X	X	X	X	X		-	P	I	T	C	H		M	I	N		I	M	P			O	F	F	
9	B	M	A	G	Z										X	X	X	X	X		+	Y	A	W				M	I	N		I	M	P			O	F	F	
10	B	M	A	G		C	T	R		A	B	L					O	F	F		-	Y	A	W				M	I	N		I	M	P			O	F	F	
11	L	E	M		A	T	T	A	C	H	E	D					O	F	F		+	R	O	L	L			M	I	N		I	M	P			O	F	F	
12	S	I	V	B		S	E	P	/	A	B	T					O	F	F		-	R	O	L	L			M	I	N		I	M	P			O	F	F	
13	T	E	M	P		C	A	U	T	I	O	N					O	F	F		I	M	U		F	A	I	L									O	F	F	
14	G	I	M	B	A	L		L	O	C	K						O	F	F		I	G	N		I	M	U		F	A	I	L					O	F	F	
15	N	O		A	T	T	I	T	U	D	E						O	F	F		I	M	U		O	P	E	R	A	T	E						O	F	F	
16	I	S	S		W	A	R	N	I	N	G						O	F	F		C	O	A	R	S	E		A	L	I	G	N					O	F	F	
17	C	M	C		W	A	R	N	I	N	G						O	F	F		Z	E	R	O		I	C	D	U	S							O	F	F	
18	O	S	C		A	L	A	R	M								O	F	F		I	M	U		E	R	R		C	T	R						O	F	F	
19	T	E	S	T		A	L	A	R	M	S						O	F	F		I	M	U		C	A	G	E									O	F	F	
20	A	B	L		C	M	C		S	T	B	Y					O	F	F		I	N	I	T	I	A	L	I	Z	E		I	S	S			O	F	F	
21	B	L	O	C	K		U	P	L	I	N	K					O	F	F		I	S	S		T	R	N	O	N		R	Q	S	T			O	F	F	
22	T	E	M	P		I	N		L	I	M						O	F	F		I	S	S		T	R	N	O	N		C	O	M	P			O	F	F	
23	P	I	P	A		F	A	I	L								O	F	F		I	S	S		C	D	U			F	A	I	L				O	F	F	
24	I	G	N		P	I	P		F	A	I	L					O	F	F		I	G	N		I	C	D	U		F	A	I	L				O	F	F	
25																																								

CRT DISPLAY
FORMAT D
FIGURE 1 D

SCOPE SPACING CHART
FOR PAGE DISPLAY

AA																																								
1		U	P	L	I	N	K		A	C	T		C	O	M	P	U	T	E	R		P	R	O	G	R	A	M		V	E	R	B			N	O	U	N	
2	K	S	E	Q									O	K											X	X					X	X					X	X		
3	K	E	Y		R	E	L	E	A	S	E						O	F	F										R	1			X	X	X	X	X			
4	U	P	L	O	C	K											O	F	F										R	2			X	X	X	X	X			
5	D	W	N	L	K		T	O	O		F	A	S	T			O	F	F										R	3			X	X	X	X	X			
6	U	P	L	N	K		T	O	O		F	A	S	T			O	F	F		O	P	E	R	A	T	O	R		E	R	R					O	F	F	
7	I	N	H	I	B	I	T		U	P	L	I	N	K			O	F	F		P	R	O	G	R	A	M			A	L	M					O	F	F	
8	S	Y	N	C		E	R	R	O	R			X	X							R	E	D	O	C	T	R						X	X	X	X	X			
9	W	O	R	D		E	R	R	O	R			X	X	X	X	X	X	X		F	A	I	L	R	E	G						X	X	X	X	X			
10	R	E	L			E	R	R	O	R			X								P	A	R		E	R	R	O	R				X							
11	V	E	R			E	R	R	O	R			X								K	E	Y		E	R	R	O	R				X	X						
12	C	M	C		T	I	M	E			X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X		S	E	C					
13	T	I	M	E		E	P	O	C	H		X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X	X		S	E	C				
14	T	I	M	E		E	R	R	O	R		X	X	X	X						Δ		T	I	M	E			X	X	X	.	X	X		S	E	C		
15	P	I	P	A		M	E	A	S			X	X	X							H	I		R	A	T	E		M	E	A	S		X	X	X	X	X	X	
16																		O	G							I	G							M	G					
17	1	7		C	D	U		A	N	G	L	E	S			X	X	X	.	X	X			X	X	X	.	X	X			X	X	X	.	X	X	D	E	G
18																					G	A	Z	I	M	U	T	H				.	X	X	X	X	X	R	A	D
19	1	9		P	I	P	A	X							X	X	X	X	X																					
20	2	0		P	I	P	A	Y							X	X	X	X	X		P	I	P	A	N											X	X	X	X	X
21	2	1		P	I	P	A	Z							X	X	X	X	X		P	I	P	A	E											X	X	X	X	X
22	2	2		A	N	G	X			.	X	X	X	X	X		R	A	D		V	D	R	I	F	T	O			X	X	X	.	X	X		M	E	R	U
23	2	3		A	N	G	Y			.	X	X	X	X	X		R	A	D		S	D	R	I	F	T	I			X	X	X	.	X	X		M	E	R	U
24	2	4		A	N	G	Z			.	X	X	X	X	X		R	A	D		E	D	R	I	F	T	T			X	X	X	.	X	X		M	E	R	U
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

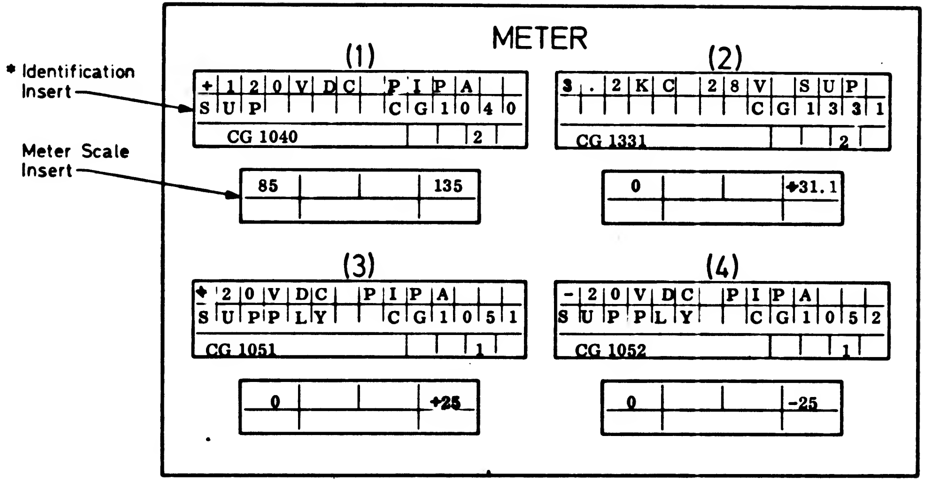
CRT DISPLAY
FORMAT E
FIGURE 1 E

3.5 METER DISPLAYS. The meter display format assignment for each Spacecraft shall be as specified in Table IV.

TABLE IV

METER DISPLAYS

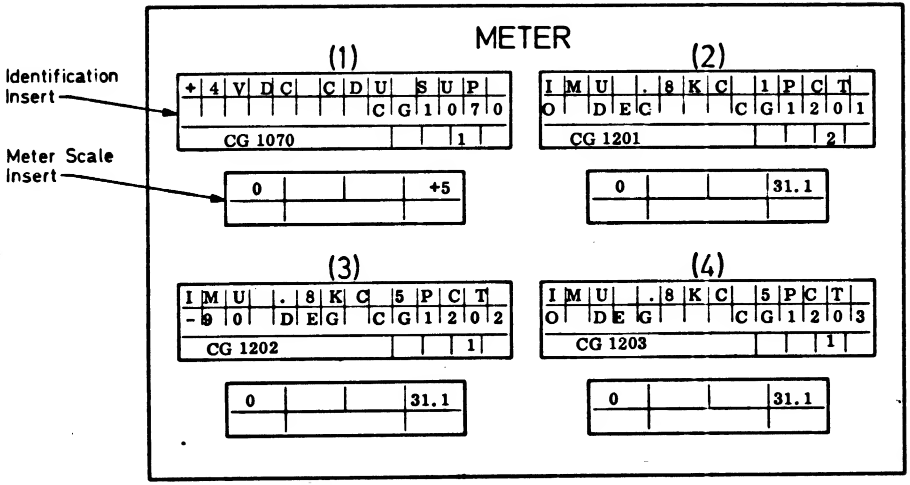
SPACE CRAFT	Console/Panel							
	004A2		004A3				014A1	
	Meter Module		Meter Module				Meter Module	
	A 3 Figure	A 4 Figure	A 6 Fig.	A 7 Fig.	A 8 Fig.	A 9 Fig.	A 3 Figure	A 4 Figure
101								
102	2A	2B	2C	2D	2E	2F	2G	2H
103								



* See Figure 7A

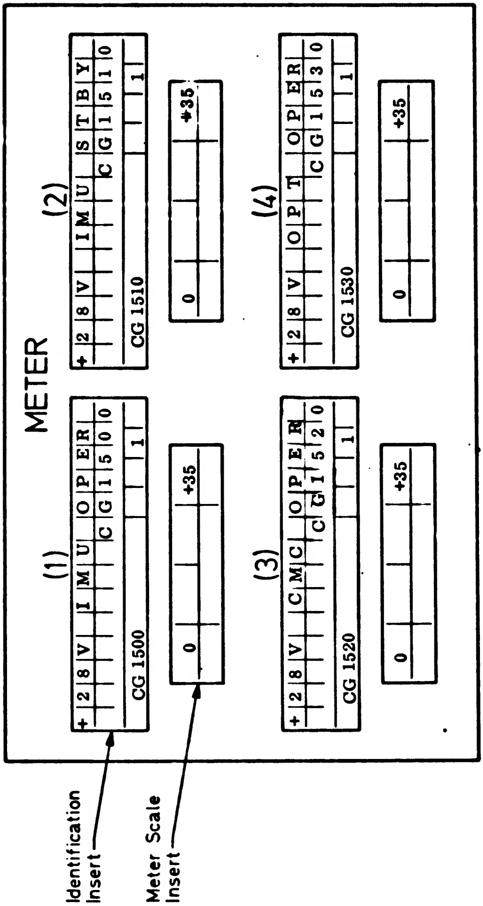
METER DISPLAY A

FIGURE 2 A



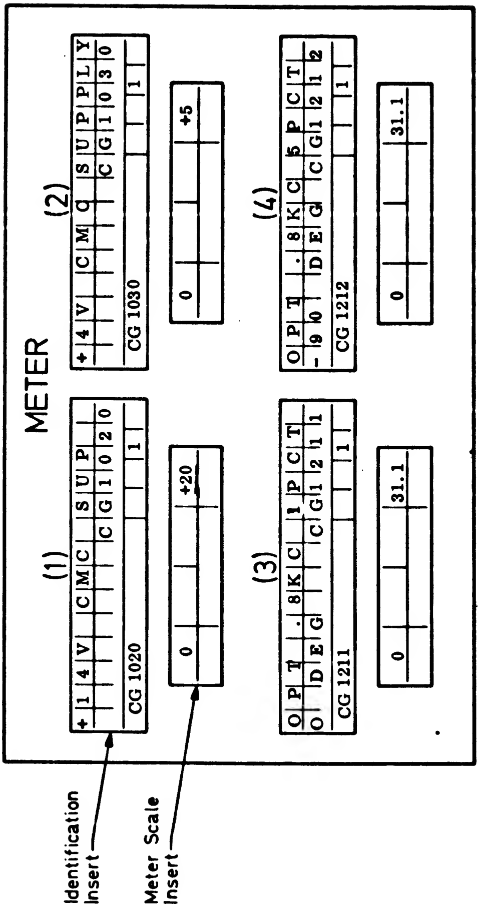
METER DISPLAY B

FIGURE 2 B



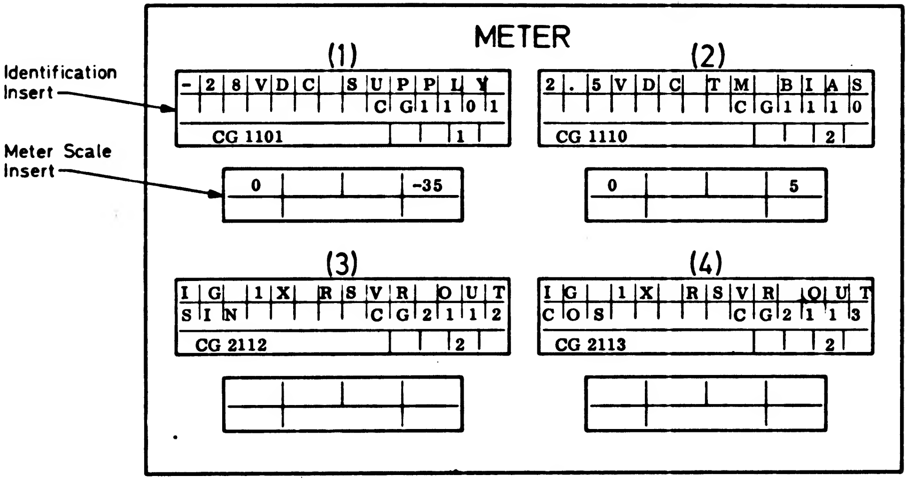
METER DISPLAY C

FIGURE 2 C



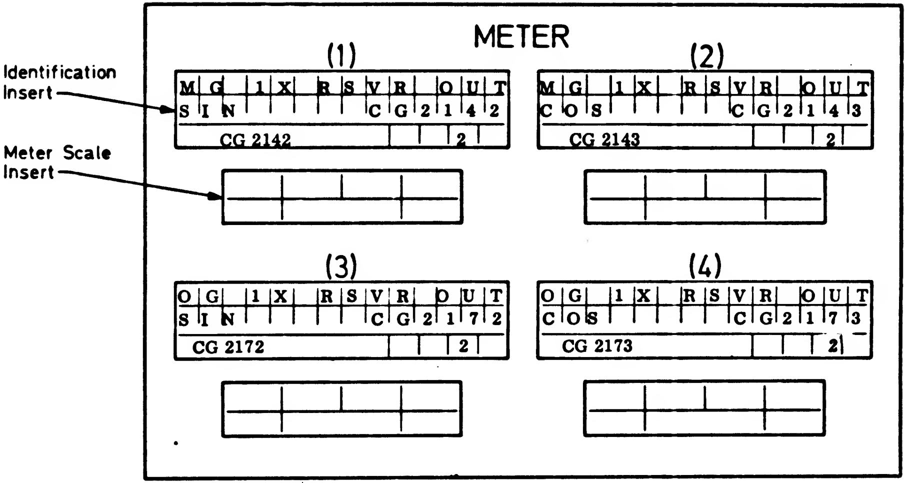
METER DISPLAY D

FIGURE 2D



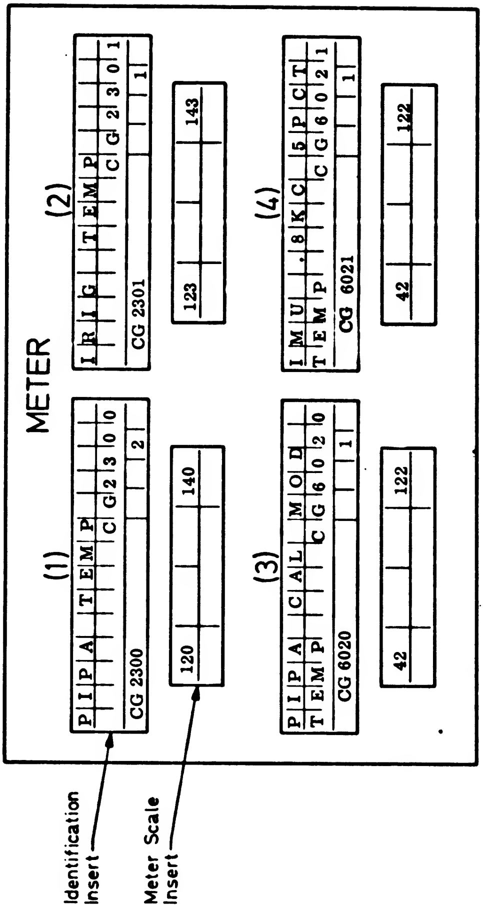
METER DISPLAY E

FIGURE 2 E



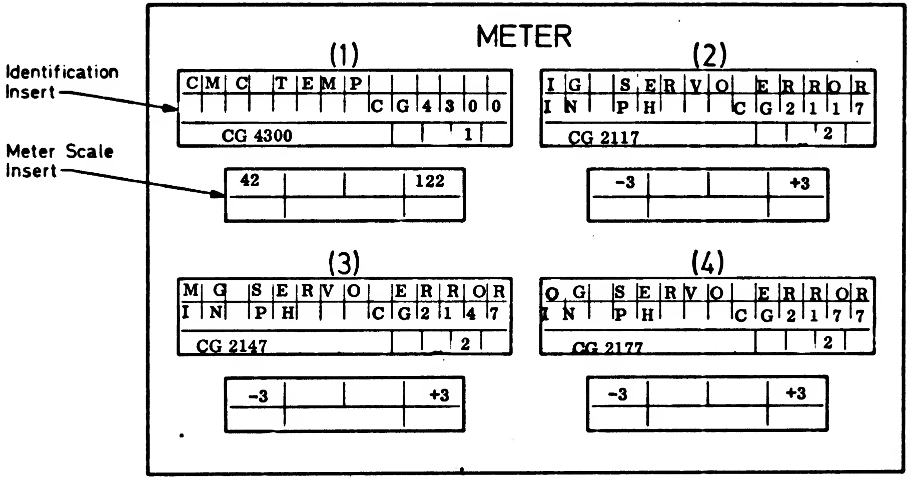
METER DISPLAY F

FIGURE 2 F



METER DISPLAY G

FIGURE 2 G



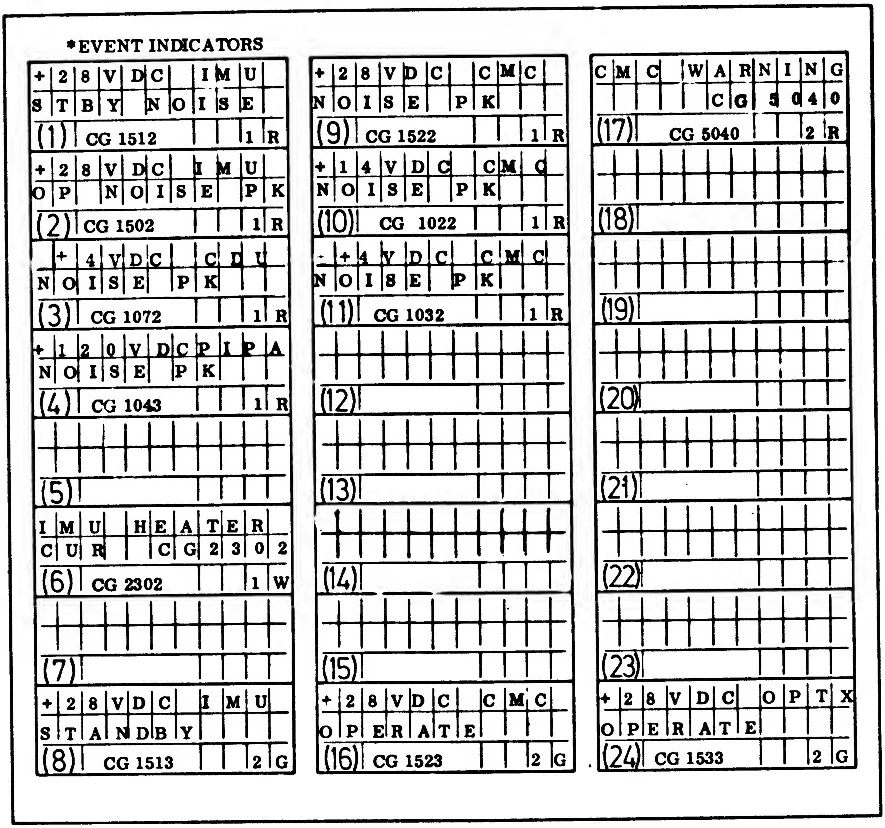
METER DISPLAY H

FIGURE 2 H

3.6 EVENT INDICATOR DISPLAYS. The event indicator display format assignment for each Spacecraft shall be as specified in Table V.

TABLE V
EVENT INDICATOR
DISPLAYS

SPACE-CRAFT	CONSOLE/PANEL				
	004A3		014A1		004A4
	Event	Module	Event	Module	Event Module
	A 4 Figure	A 5 Figure	A 1 Figure	A 2 Figure	
101					
102		3A		3A	
103					



* See Figure 7B

EVENT INDICATOR DISPLAY A

FIGURE 3 A

3.7 EVENT RECORDER SIGNAL ARRANGEMENT. The signals recorded on the 32 channel Event Recorder, Panel/Module Number 004A2A2, shall be arranged as specified in Table VI.

TABLE VI

EVENT RECORDER SIGNAL ARRANGEMENT

SPACECRAFT	SIGNAL ARRANGEMENT FIGURE
101	
102	4A
103	

FORMAT 8A

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			
2	CG 1523	2	+28VDC CMC OPER
3	CG 1522	1	+28VDC CMC NOISE PK
4	CG 1022	1	+14VDC CMC NOISE PK
5	CG 1032	1	+ 4VDC CMC NOISE PK
6	CG 1513	2	+28VDC IMU STBY
7	CG 1512	1	+28VDC IMU STBY NOISE
8	CG 1502	1	+28VDC IMU OP NOISE PK
9	CG 1072	1	+ 4VDC CDU NOISE PK
10	CG 1043	1	+120VDC PIPA NOISE PK
11			
12	CG 1533	2	+28VDC OPTX OPER
13	CG 1532	1	+28VDC OPTX NOISE PK
14			
15	CG 5040	2	CMC WARNING
16			
17	CG 2302	1	IMU HEATER CUR
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

EVENT RECORDER

SIGNAL ARRANGEMENT

FIGURE 4A

3.8 ANALOG RECORDER SIGNAL ARRANGEMENT. The signals recorded on the Analog Recorder shall be arranged as specified in Table VII.

TABLE VII

ANALOG RECORDER SIGNAL ARRANGEMENT

SPACECRAFT	CONSOLE/ PANEL		
	004A1		004A3
	Analog Module		Analog Module
	A 2	A 3	A 02
101			
102	Fig. 5A	Fig. 5B	Fig. 5C
103			

CHANNEL

1	2	3
SXT SHAFT SERVO ERROR IN PH CG 3117	SXT TRUN SERVO ERROR IN PH CG 3118	SHAFT CDU FINE ERROR RMS CG 3021
Measurement No. CG 3117 Link No. 1	Measurement No. CG 3118 Link No. 1	Measurement No. CG 3021 Link .No. 1
4	**5**	**6**
TRUN CDU FINE ERROR RMS CG 3011	SXT SHAFT TACH OUTPUT IN PH CG 3140	SXT TRUN TACH OUTPUT IN PH CG 3150
Measurement No. CG 3011 Link No. 1	Measurement No. CG 3140 Link No. 1	Measurement No. CG 3150 Link No. 1
7	**8**	
SHAFT CDU DAC OUTPUT CG 3721	TRUN CDU DAC OUTPUT CG 3722	
Measurement No. CG 3721 Link No. 2	Measurement No. CG 3722 Link No. 2	

8 CHANNEL ANALOG RECORDER
SIGNAL ARRANGEMENT A

FIGURE 5 A

CHANNEL

1	2	3
HI RATE CHANNEL	+14V CMC SUPPLY DC LEVEL CG 1020	+4V CMC SUPPLY DC LEVEL CG 1030
Measurement No. Link No.	Measurement No. CG 1020 Link No. 1	Measurement No. CG 1030 Link No. 1

4	5	6
PITCH ATT ERR - CDU DAC OUT IN PH CG 2219	YAW ATT ERR - CDU DAC OUT IN PH CG 2249	ROLL ATT ERR - CDU DAC OUT IN PH CG 2279
Measurement No. CG 2219 Link No. 1	Measurement No. CG 2249 Link No. 1	Measurement No. CG 2279 Link No. 1

7	8
PIPA TEMPERATURE CG 2300	IRIG TEMPERATURE CG 2301
Measurement No. CG 2300 Link No. 2	Measurement No. CG 2301 Link No. 1

8 CHANNEL ANALOG RECORDER
SIGNAL ARRANGEMENT B

FIGURE 5 B

SWITCH POSITION

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	CG 2120	1	IG TORQUE MOT CURRENT CG 2120
1	2	CG 2177	2	OG SERVO ERROR IN PH CG 2177
1	3	CG 3145	1	SXT SHAFT MOT CONT WD CG 3145
1	4			
2	1	CG 6020	1	PIPA CAL MOD TEMP CG 6020
2	2	CG 2180	1	OG TORQUE MOT CURRENT CG 2180
2	3	CG 2147	2	MG SERVO ERROR IN PH CG 2147
2	4			
3	1	CG 2117	2	IG SERVO ERR IN PH CG 2117
3	2	CG 3155	1	SXT TRUN MOT CONT WD CG 3155
3	3	CG 2150	1	MG TORQUE MOT CURRENT CG 2150
3	4			
4	1	CG 2112	2	IG 1 X RSVR OUT SIN CG 2112
4	2	CG 2280	1	OG CDU FINE ERROR CG 2280
4	3	CG 2143	2	MG 1X RSVR OUT COS CG 2143
4	4			
5	1	CG 2113	2	IG 1X RSVR OUT COS CG 2113
5	2	CG 2172	2	OG 1X RSVR OUT SIN CG 2172
5	3	CG 2250	1	MG CDU FINE ERROR CG 2250
5	4			
6	1	CG 2220	1	IG CDU FINE ERROR CG 2220
6	2	CG 2173	2	OG 1X RSVR OUT COS CG 2173
6	3	CG 2142	2	MG 1X RSVR OUT SIN CG 2142
6	4			
7	1	CG 4300	1	CMC TEMP CG 4300
7	2	CG 1520	1	+28V CGC OPER CG 1520
7	3	CG 3170	2	SCT TRUN TACH OUT CG 3170
7	4			
8	1	CG 1201	2	IMU 28 V 1 PCT CG 1201
8	2	CG 1040	2	+120V PIPA SUP CG 1040
8	3	CG 3160	2	SCT SHAFT TACH OUT CG 3160
8	4			
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

32 CHANNEL ANALOG RECORDER

SIGNAL ARRANGEMENT C

FIGURE 5 C

3.9 R-START SIGNAL ARRANGEMENT. The R-START signal arrangement for each Spacecraft shall be as specified in Table VIII.

TABEL VIII

R-START SIGNAL
ARRANGEMENT

SPACECRAFT	CONSOLE/PANEL	
	004A2	004A4
	Module A6	Module A5
101		
102	Figure 6B	Figure 6A
103		

R-START 144				R-START 145			
Special K-Start Verify KZ0016	Special K-Start Load-Verify KZ0015		G&N ERROR RESET KZ0014				
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START 146				R-START 147			
				Guidance Reference Release KV7043		CMC Liftoff Signal KV7044	
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START SIGNAL ARRANGEMENT A

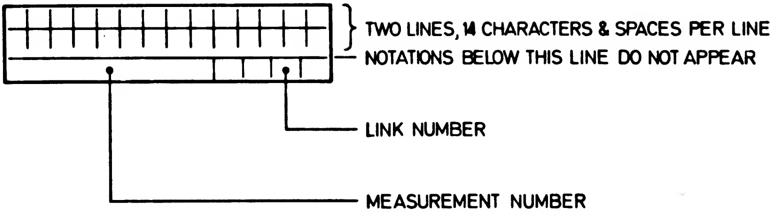
FIGURE 6 A

R-START 152				R-START 153			
	CMC TIME X MISSION	CMC TIME CORRECTION & VERIF.	CMC CLOCK INITIAL.	PIPA REFERENCE COMMANDS	X PIPA OUTPUT	Y PIPA OUTPUT	Z PIPA OUTPUT
	KZ 0013	KZ 0012	KZ 0011	KG 7009	KG 7010	KG 7011	KG 7012
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

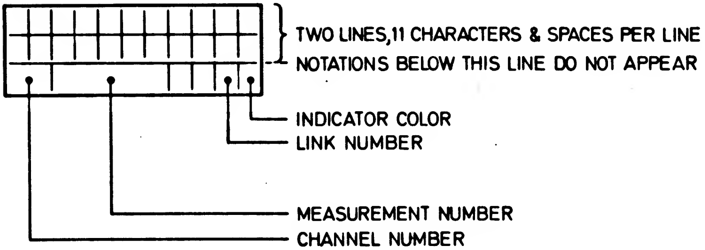
R-START 154				R-START 155			
	CMC 14 VOLT STIMULI DAC 8	CMC 4 VOLT STIMULI DAC 7	CMC MARGIN TEST ENABLE	IGA STEP COMMAND	MGA STEP COMMAND	OGA STEP COMMAND	
	KG 7021	KG 7020	KG 7019	KG 7013	KG 7014	KG 7015	
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START SIGNAL ARRANGEMENT B

FIGURE 6 B


TWO LINES, 14 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
LINK NUMBER
MEASUREMENT NUMBER

7 A. - METER IDENTIFICATION INSERT


TWO LINES, 11 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
INDICATOR COLOR
LINK NUMBER
MEASUREMENT NUMBER
CHANNEL NUMBER

7 B. - EVENT INDICATOR DISPLAY FORMAT

FIGURE 7

4. QUALITY ASSURANCE PROVISIONS

4.1 INSPECTION. The requirements specified in Section 3 shall be verified by visual inspection.

5. PREPARATION FOR DELIVERY. This section is not applicable to this specification.

6. NOTES.

6.1 VARIATIONS TO SIGNAL ARRANGEMENT. Signal arrangements within a display module or assembly may be varied, but the signals shall be retained by the original module or assembly specified. The signal arrangement for the CRT display (3.4) shall be restricted to variations within the half page specified.

b. The following signals shall have blink limits of ±4095:

NG 1021
NG 1031
NG 1071
NG 1501
NG 1511
NG 1521
GG 2001
GG 2021
GG 2041
GG 2106
GG 2107
GG 2110
GG 2121
GG 2136
GG 2137
CG 2138
GG 2140
GG 2147
GG 2151
GC 2166
CG 2167
CG 2170
CG 2181
GG 2219
GG 2220
CG 2221
GG 2249
GG 2250
GG 2251
GG 2279
GG 2280
GG 2281
GG 2300
GG 2301
GG 3304
GG 3305
GG 3324
GG 3325
GG 3311
GG 3312
GG 3321
GG 3322
GG 4300
GG 6020
GG 6021

3.3 HIGH RATE MEASUREMENTS. The C START Panel shall program the signals specified in Table II.

TABLE II

HIGH RATE MEASUREMENTS

SIGNAL PROGRAMMED MEAS NO.
GG 2106
▲ 2110
2136
2140
2166
2170
2220
2250
2280
▼ 3311
GG 3321

3.4 CRT DISPLAYS. The CRT screen on the CRT module shall display information for each LM in accordance with Table III.

TABLE III

LM/CRT DISPLAY

LM	CRT DISPLAY FORMAT FIGURE
1	1A 1B 1C 1D 1E
2	1A, 1B, 1C, 1D, 1E,
3	1A 1B 1C 1D 1E

3.4.1 Measurement Numbers. Table IV correlates the signal measurement numbers to the scope spacing chart displays and indicates location of measurement within the display.

TABLE IV

CRT DISPLAY ASSIGNMENT MEASUREMENT LIST

SIGNAL NUMBER	CRT FIG-LINE
GG 1020	1A-15
1030	1A-16
1040	1A-20
1070	1A-19
1100	1A-21
1110	1A-22
1201	1A-21
1202	1A-22
1203	1A-23
1331	1A-24
1500	1A-18
1510	1A-17
1513	1A-14
2001	1B-3
2021	1B-3
2041	1B-3
2106	1B-5
2107	1B-6
2110	1B-4
2112	1B-7
2113	1B-8
2112/2113 **	1B-15
2121	1B-17
2136	1B-5
2137	1B-6
2140	1B-4
2142	1B-7
2143	1B-8
2142/2143 **	1B-15
2151	1B-17
2166	1B-5
2167	1B-6
2170	1B-4
2172	1B-7
2173	1B-8
2172/2173 **	1B-15
2181	1B-17
GG 2219	1B-16
2220	1B-10
2221	1B-9
2249	1B-16
2250	1B-10
2251	1B-9
2279	1B-16
2280	1B-10
2281	1B-9
2300	1B-24
2301 *	1B-24
3304	1E-2
3305	1E-3
3304/3305 ***	1E-4
3311	1E-6
3312	1E-7
3321	1E-6
3322	1E-7
3324	1E-2
3325	1E-3
3324/3325 ***	1E-4
4300	1E-21
6020	1E-21
GG 6021	1E-21
NG 1021	1A-15
1031	1A-16
1071	1A-19
1336	1A-24
1501	1A-18
1511	1A-17
NG 1521	1A-14
GN 7523	1D-22
7524	1D-23
7525	1D-24
7527	1D-21
7614	1E-11
7616	1E-10

NOTE: * Use LINK 5
** Processed by G&N 652
*** Processed by G&N 653

SCOPE SPACING CHART
FOR PAGE DISPLAY

AA																																								
1	0	1		L	R		A	L	T		D		O	K				O	X		R	R		O	N	/	A	U	T	O								O	X	
2	0	2		L	R	A	L	T		L	O	-	S	C				O	X		R	R		R	A	N	G	E		L	O	-	S	C				O	X	
3	0	3		L	R		V	E	L		D		O	K				O	X		R	R		D	A	T	A		G	O	O	D						O	X	
4	D	4		L	R		V	E	L		F	A	I	L				O	X		R	R		D	A	T	A		F	A	I	L						O	X	
5	0	5		L	R		P	O	S	2		C	M	D				O	X		R	R		L	O	C	K	O	N		A	B	L					O	X	
6	0	6		L	R		P	O	S		1							O	X		R	R		A	N	T		O	U	T								O	X	
7	0	7		L	R		P	O	S		2							O	X		R	R		A	N	T		M	O	D	E							O	X	
8	0	8		L	R		A	L	T		F	A	I	L				O	X		R	R		A	N	T		R	E	M	D							O	X	
9	0	9		F	O	R	V	E	L		X	X	X	.	X	X		F	P	S		L	A	T	V	E	L			X	X	X	.	X	X		F	P	S	
10	10	0		A	L	T		R	A	T	E				X	X	X	X	.	X		F	P	S																
11	1	1		H	O	R	I	Z		V	E	L						O	X		A	L	T		R	A	T	E		S	E	L						O	X	
12	1	2		R	R		E	R		C	T	R						O	X		A	L	T		M	E	T	E	R		A	C	T					O	X	
13		G	G				S	U	P	P	L	Y					V	D	C			N	G				N	O	I	S	E					V	R	M	S	
14	1	5	2	0		+	2	8		L	G	C				X	X	.	X		1	5	2	1		+	2	8		L	G	C				X	.	X	X	
15	1	0	2	0		+	1	4		L	G	C				X	X	.	X		1	0	2	1		+	1	4		L	G	C				X	.	X	X	
16	1	0	3	0		+		4		L	G	C				X	.	X	X		1	0	3	1		+		4		L	G	C				X	.	X	X	
17	1	5	1	0		+	2	8		S	T	B	Y			X	X	.	X		1	5	1	1		+	2	8		S	T	B	Y			X	.	X	X	
18	1	5	0	0		+	2	8		O	P	E	R			X	X	.	X		1	5	0	1		+	2	8		O	P	E	R			X	.	X	X	
19	1	0	7	0		+		4		C	D	U				X	.	X	X		1	0	7	1		+		4		C	D	U				X	.	X	X	
20	1	0	4	0		1	2	0		P	I	P					X	X	X			G	G				S	U	P	P	L	Y				V	R	M	S	
21	1	1	0	0		−	2	8		S	U	P			-	X	X	.	X		1	2	0	1		I	M	U		1	%	O				X	X	.	X	
22	1	1	1	0		T	M		B	I	A	S				X	.	X	X		1	2	0	2		I	M	U		5	%	W				X	X	.	X	
23		N	G			P	H		D	I	F						D	E	G		1	2	0	3		I	M	U		5	%	O				X	X	.	X	
24	1	3	3	6		3	·	2	/	L	G	C				X	X	X			1	3	3	1		2	8	V	3	.	2	K	C			X	X	.	X	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT A

FIGURE 1A

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1			I	S	S		M	E	A	S					X	/	O	G					Y	/	I	G				Z	/	M	G					
2	0	2		P	I	P	A		C	T	R					X	X	X	X	X			X	X	X	X	X			X	X	X	X	X						
3	0	3		P	I	P	A		S	G		0						X	.	X	X		.		X	.	X	X				X	.	X	X					
4	0	4		T	O	R		M	O	T		C	U	R				.	X	X	X				.	X	X	X				.	X	X	X		A	M	P	S
5	0	5		S	E	R	V	O		E	R		T	L				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
6	0	6		S	E	R	V	O		E	R		0					X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
7	0	7		1	X		R	S	V	R		S	I	N				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S
8	0	8		1	X		R	S	V	R		C	O	S				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S
9	0	9		C	D	U		C	R	S		E	R	R				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
10	1	0		C	D	U		F	I	N		E	R	R				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
11	1	1																																						
12	1	2																																						
13	1	3			I	S	S		M	E	A	S			X	/	Y	A	W			Y	/	P	I	T	C	H			Z	/	R	O	L	L				
14	1	4		C	D	U		A	N	G	L	E				X	X	X	.	X	X		X	X	X	.	X	X		X	X	X	.	X	X			D	E	G
15	1	5		G	I	M	B		A	N	G	L	E					X	X	X					X	X	X					X	X	X				D	E	G
16	1	6		D	A	C		A	T	T		E	R					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G
17	1	7		1	X		S	I	N		1	1	°					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G
18	1	8		I	M	U		O	P	E	R							O	X		I	S	S		T	R	N	O	N		R	Q	S	T				O	X	
19	1	9		I	M	U		C	A	G	E							O	X		I	S	S		T	R	N	O	N		C	O	M	P				O	X	
20	2	0		C	D	U		C	O	N	T	R	O	L				O	X		I	N	I	T	I	A	L	I	Z	E		I	S	S				O	X	
21	2	1		C	O	R	S	E		A	L	I	G	N				O	X		D	S	P		I	N	R	T	L		D	A	T	A				O	X	
22	2	2		Z	E	R	O		I	C	D	U						O	X		I	S	S		E	R	R		C	T	R							O	X	
23	2	3		T	E	M	P		I	N		L	I	M				O	X		N	O		A	T	T	I	T	U	D	E							O	X	
24	2	4		P	I	P	A		T	E	M	P				X	X	X	.	X	°	F		I	R	I	G		T	E	M	P		X	X	X	.	X	°	F *
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

* IRIG TEMP (GG2301) is LINK 5

CRT DISPLAY

FORMAT B

FIGURE 1B

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																									
1	0	1					A	C	T	I	V	I	T	Y							P	R	O	G	R	A	M				V	E	R	B		N	O	U	N		
2	0	2		U	P	L	I	N	K		C	O	M	P	U	T	E	R					X	X								X	X				X	X			
3	0	3		I	S	S		M	O	D	E		X	X	X	X	X	X											R	1			X	X	X	X	X				
4	0	4		I	N	H	I	B		U	P	L	I	N	K			O	X										R	2			X	X	X	X	X				
5	0	5		B	L	O	C	K		U	P	L	I	N	K			O	X										R	3			X	X	X	X	X				
6	0	6		U	P	L	O	C	K									O	X		K	E	Y		R	E	L	E	A	S	E							O	X		
7	0	7		U	P	L	N	K		F	A	S	T					O	X		O	P	E	R	A	T	O	R		E	R	R						O	X		
8	0	8		G	I	M	B	A	L		L	O	C	K				O	X		P	R	O	G	R	A	M			A	L	M						O	X		
9	0	9		I	M	U					F	A	I	L				O	X		T	E	M	P		C	A	U	T	I	O	N						O	X		
10	1	0		P	I	P	A				F	A	I	L				O	X		R	E	D	O	T	R							X	X	X	X	X				
11	1	1		I	S	S	C	D	U		F	A	I	L				O	X		L	M	P	C	M	D							X	X	X	X	X				
12	1	2		R	R		C	D	U		F	A	I	L				O	X		F	A	I	L	R	E	G						X	X	X	X	X				
13	1	3		W	O	R	D		E	R	R	X	X	X	X	X	X	X			O	S	C		A	L	A	R	M									O	X		
14	1	4		S	Y	N	C		E	R	R					X	X	X			T	R	A	C	K	E	R		F	A	I	L						O	X		
15	1	5		R	E	L			E	R	R						X				T	E	S	T		A	L	A	R	M	S							O	X		
16	1	6		K	E	Y			E	R	R						X	X			A	B	L		L	G	C		S	T	B	Y						O	X		
17	1	7		P	A	R			E	R	R						X				P	I	P	A		M	E	A	S								X	X	X		
18	1	8		V	E	R			E	R	R						X				H	I		R	A	T	E							G	G	X	X	X	X		
19	1	9		K	S	E	Q						O	K							I	G	N	I	C	D	U		F	A	I	L						O	X		
20	2	0		I	G	N	P	I	P		F	A	I	L				O	X		I	G	N	R	C	D	U		F	A	I	L						O	X		
21	2	1		I	G	N	I	M	U		F	A	I	L				O	X		T	I	M	E		E	R	R	O	R			X	X	X	X					
22	2	2		Δ	T	I	M	E		X	X	X	.	X	X	X	S	E	C																					
23	2	3		T	I	M	E		E	P				X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X	X		S	E	C		*
24	2	4		L	G	C		T	I	M	E			X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X			S	E	C		
25																																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	

* TIME EP = "TIME EPOCH" OR "TIME EPHEMERIS," WHICHEVER APPLICABLE.

CRT DISPLAY

FORMAT C

FIGURE 1C

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1		+	Y	M	I											O	X		J	E	T	S		2	-	4		F	A	I	L					O	X	
2	0	2		-	Y	M	I											O	X		J	E	T	S		5	-	8		F	A	I	L					O	X	
3	0	3		+	E	L	L	P	D	/	+	P	M	I				O	X		J	E	T	S		1	-	3		F	A	I	L					O	X	
4	0	4		-	E	L	L	P	D	/	-	P	M	I				O	X		J	E	T	S		6	-	7		F	A	I	L					O	X	
5	0	5		+	A	Z	L	P	D	/	+	R	M	I				O	X		J	E	T	S		1	4	-	1	6		F	L					O	X	
6	0	6		-	A	Z	L	P	D	/	-	R	M	I				O	X		J	E	T	S		1	3	-	1	5		F	L					O	X	
7	0	7		+	X		T	R	A	N	S							O	X		J	E	T	S		9	-	1	2			F	L					O	X	
8	0	8		-	X		T	R	A	N	S							O	X		J	E	T	S		1	0	-	1	1		F	L					O	X	
9	0	9		+	Y		T	R	A	N	S							O	X		P	G	N	C	S		C	O	N	T		L	M					O	X	
10	1	0		-	Y		T	R	A	N	S							O	X		A	T	T	I	T	U	D	E		H	O	L	D					O	X	
11	1	1		+	Z		T	R	A	N	S							O	X		A	U	T	O		S	T	A	B									O	X	
12	1	2		-	Z		T	R	A	N	S							O	X		A	T	T		C	O	N	T		D	E	T						O	X	
13	1	3		E	N	G	I	N	E		O	N						O	X		P	I	T	C	H		G	I	M	B		O	F	F				O	X	
14	1	4		E	N	G	I	N	E		O	F	F					O	X		R	O	L	L			G	I	M	B		O	F	F				O	X	
15	1	5		+	P	I	T	C	H		T	R	I	M				O	X		E	N	G	I	N	E		A	R	M	E	D						O	X	
16	1	6		-	P	I	T	C	H		T	R	I	M				O	X		S	T	A	G	E		V	E	R	I	F							O	X	
17	1	7		+	R	O	L	L			T	R	I	M				O	X		A	B	O	R	T		S	T	A	G	E							O	X	
18	1	8		-	R	O	L	L			T	R	I	M				O	X		A	B	O	R	T													O	X	
19	1	9		A	U	T	O		T	H	R	O	T					O	X		T	H	R	U	S	T		D	R	V								O	X	
20	2	0																																						
21	2	1			L	R		A	L	T		F	T										X	X	X	X	X	X	X	X	X	.	X	X	X	X				
22	2	2			L	R		V	X			F	P	S									X	X	X	X	X	X	X	X	X	.	X	X	X	X				
23	2	3			L	R		V	Y			F	P	S									X	X	X	X	X	X	X	X	X	.	X	X	X	X				
24	2	4			L	R		V	Z			F	P	S									X	X	X	X	X	X	X	X	X	.	X	X	X	X				
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT D

FIGURE 1D

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1		R	R		S	H	A	F	T														R	R			T	R	U	N	N	I	O	N						
2	0	2		1	X		S	I	N		V	R	M	S		X	X	.	X					1	X		S	I	N		V	R	M	S		X	X	.	X	
3	0	3		1	X		C	O	S		V	R	M	S		X	X	.	X					1	X		C	O	S		V	R	M	S		X	X	.	X	
4	0	4		A	N	G	L	E				D	E	G			X	X	X					A	N	G	L	E			D	E	G			X	X	X		
5	0	5		C	D	U		∠		D	E	G		X	X	X	.	X	X					C	D	U		∠		D	E	G		X	X	X	.	X	X	
6	0	6		F	I	N		E	R		V	R	M	S		X	.	X	X				F	I	N	E		E	R		V	R	M	S		X	.	X	X	
7	0	7		C	R	S		E	R		V	R	M	S		X	.	X	X				C	R	S			E	R		V	R	M	S		X	.	X	X	
8	0	8		A	L	T	S	A	V	E			D	P											X	X	X	X	X	X	X	.	X	X	X		F	E	E	T
9	0	9		F	I	N	A	L	T				D	P											X	X	X	X	X	X	X	.	X	X	X		F	E	E	T
10	1	0		R	R		R	A	N	G	E												X	X	X	X	X	X	X	X	X	X	.	X	X	X		F	T	
11	1	1		R	R		R	A	N	G	E		R	A	T	E							X	X	X	X	X	X	X	X	X	X	.	X	X	X		F	P	S
12	1	2		Z	E	R	O		R	R		C	D	U				O	X		C	O	N	T		D	E	S	I	G								O	X	
13																																								
14																																								
15																																								
16																																								
17																																								
18																																								
19																																								
20																L	G	C				C	A	L		M	O	D			P	S	A							
21	2	1		T	E	M	P	E	R	A	T	U	R	E		X	X	X						X	X	X					X	X	X				D	E	G	F
22	2	2		A	N	G	X	/	P	I	P	E		X	X	X	X	X				V	D	R	I	F	T	O	±	X	X	X	.	X	X		M	E	R	U
23	2	3		A	N	G	Y	/	P	I	P	N		X	X	X	X	X				S	D	R	I	F	T	I	±	X	X	X	.	X	X		M	E	R	U
24	2	4		A	N	G	Z						±	X	X	X	X	X				E	D	R	I	F	T	T	±	X	X	X	.	X	X		M	E	R	U
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT E

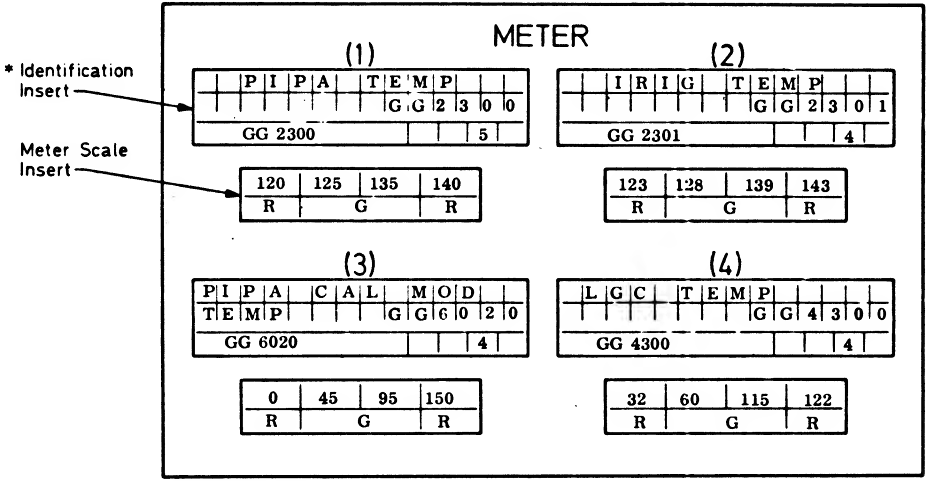
FIGURE 1E

3.5 METER DISPLAYS. The meter display format assignment for each LM shall be as specified in Table V. Meter scaling and color band coding are specified for reference and are subject to change by the user.

TABLE V

METER DISPLAYS

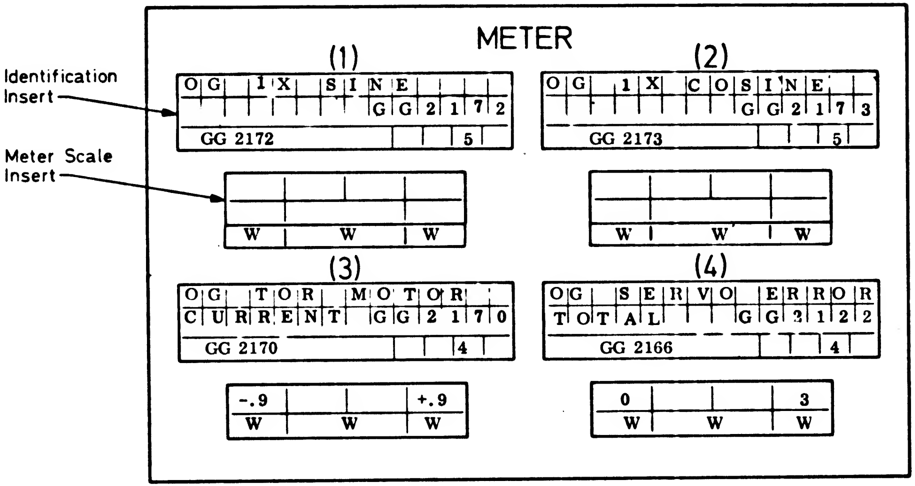
LM	Console Panel							
	004A2		004A3				014A1	
	Meter Module		Meter Module				Meter Module	
	A3 Figure	A4 Figure	A6 Fig.	A7 Fig.	A8 Fig.	A9 Fig.	A3 Figure	A4 Figure
1	2A	2B	2C	2D	2E	2G	2H	2F
2	2A	2B	2C	2D	2E	2G	2H	2F
3	2A	2B	2C	2D	2E	2G	2H	2F



* See Figure 7A

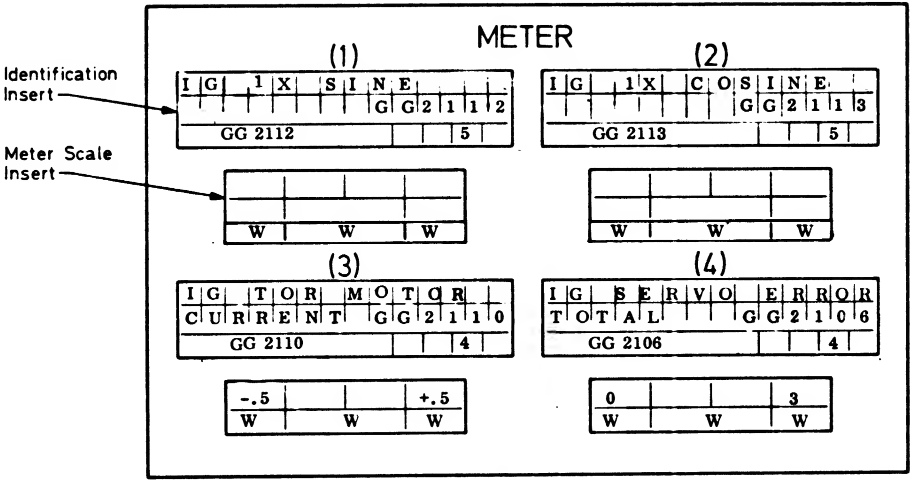
METER DISPLAY A

FIGURE 2A



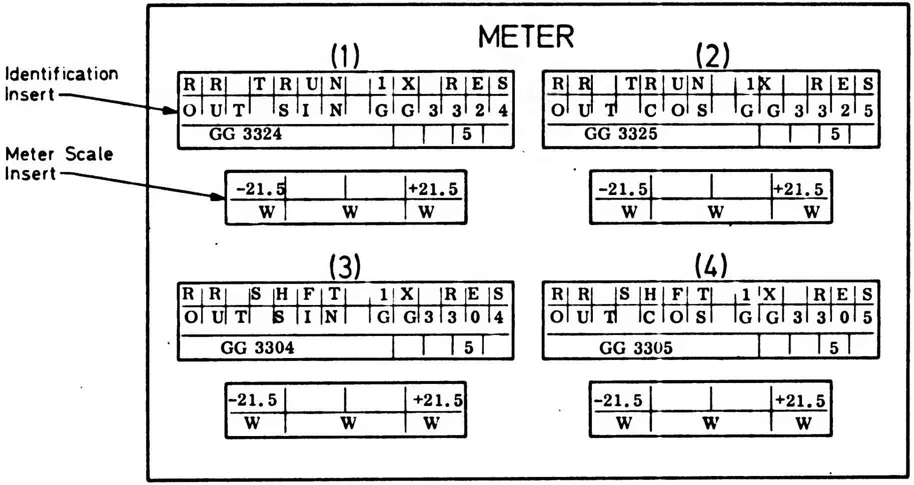
METER DISPLAY B

FIGURE 2B



METER DISPLAY C

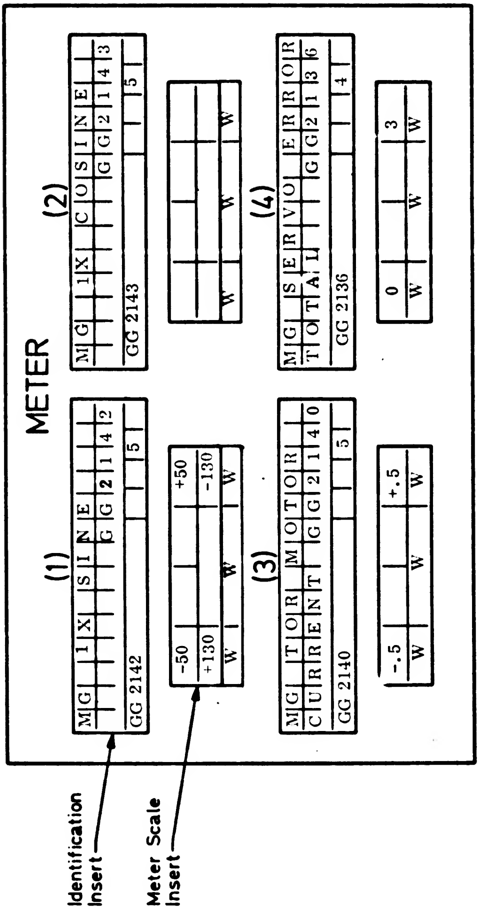
FIGURE 2C



METER DISPLAY D

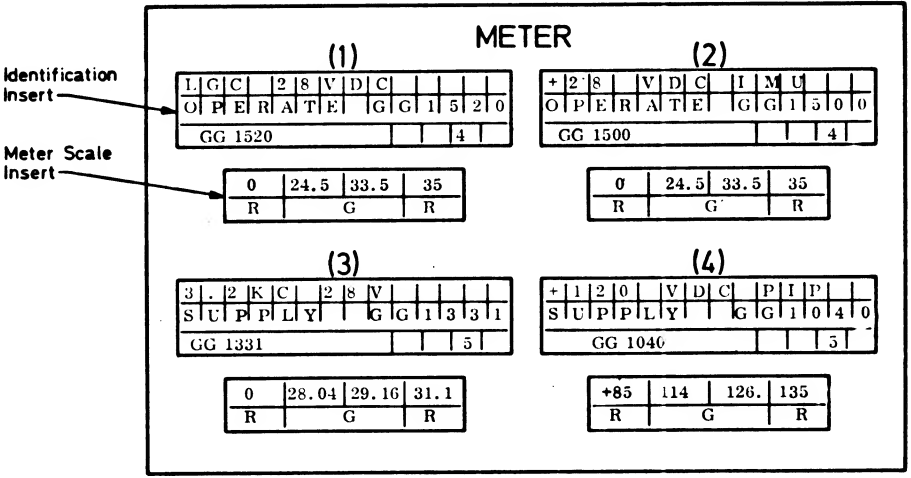
FIGURE 2D

]



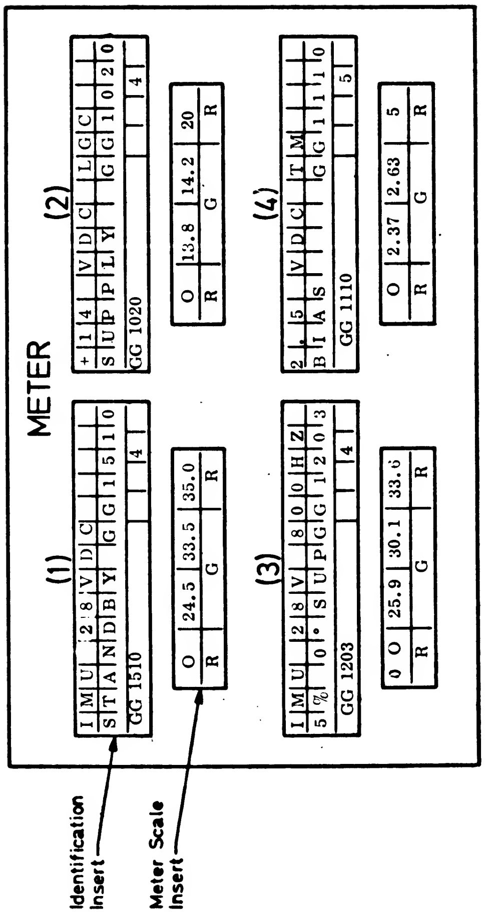
METER DISPLAY E

FIGURE 2E



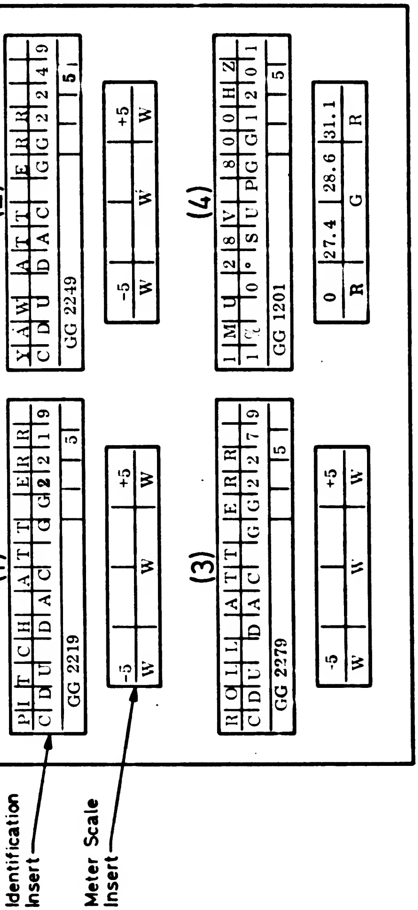
METER DISPLAY F

FIGURE 2F



METER DISPLAY G

FIGURE 2G



METER DISPLAY H

FIGURE 2H

3.6 **EVENT INDICATOR DISPLAYS.** The event indicator display format assignment for each LM shall be as specified in Table VI.

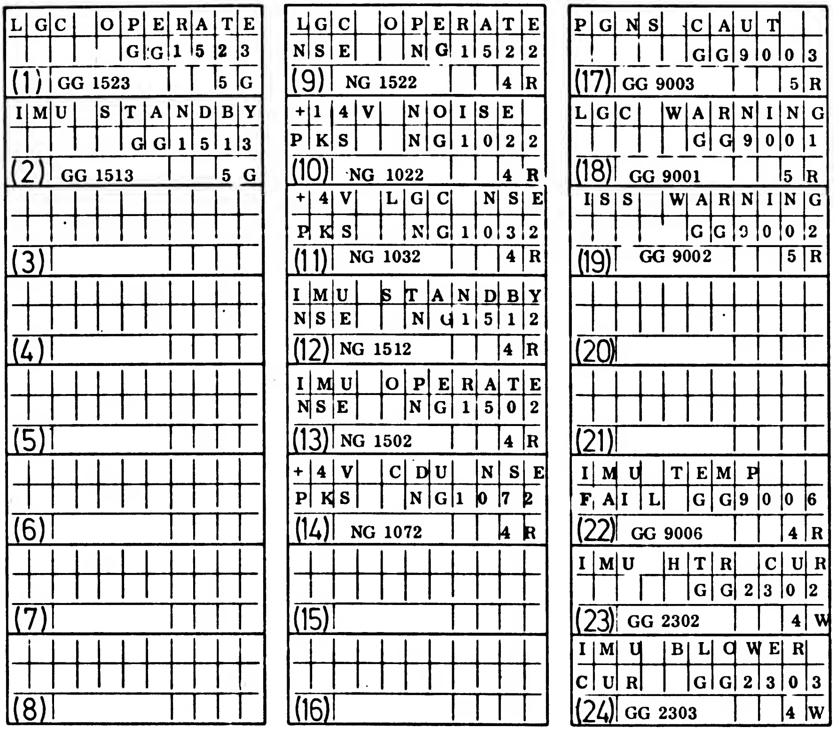
TABLE VI

EVENT INDICATOR

DISPLAYS

LM	CONSOLE/PANEL					
	004A3		014A1		004A4	
	Event	Module	Event	Module	Event	Module
	A4 Figure	A5 Figure	A1 Figure	A2 Figure		
1	3A	3B	3B	3A		
2	3A	3B	3B	3A		
3	3A	3B	3B	3A		

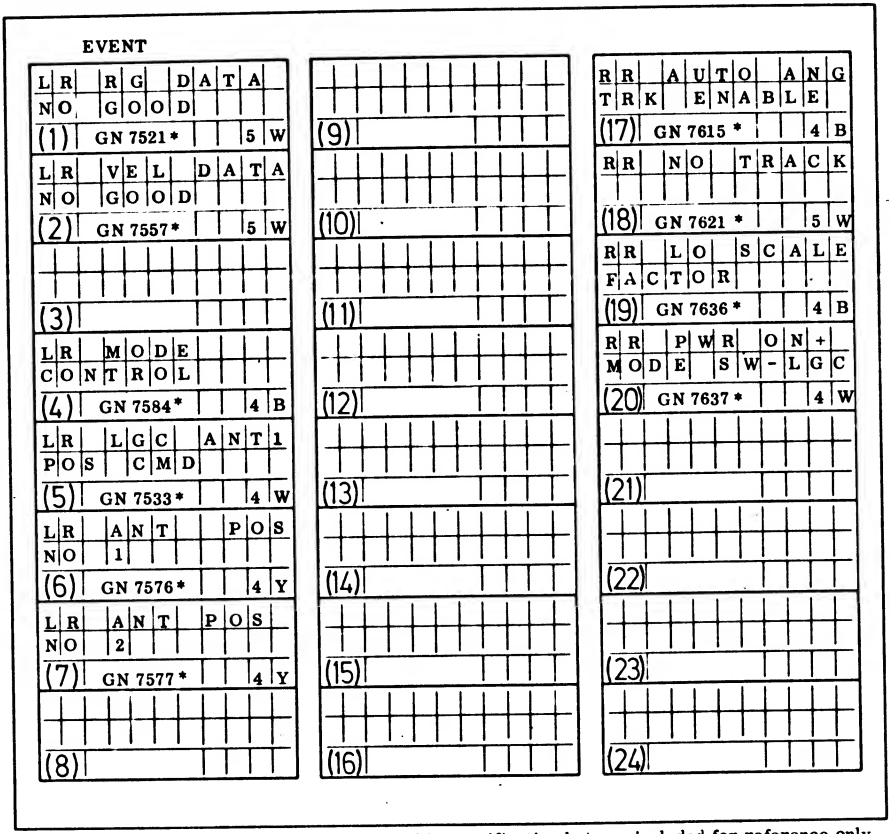
*** EVENT INDICATORS**



* See Figure 7B

EVENT INDICATOR DISPLAY A

FIGURE 3A



*These measurements are not controlled by this specification but are included for reference only

EVENT INDICATOR DISPLAY B

FIGURE 3B

3.7 EVENT RECORDER SIGNAL ARRANGEMENT. The signals recorded on the 32 channel Event Recorder, Panel/Module Number 004A2A2 shall be arranged as specified in Table VII.

TABLE VII

EVENT RECORDER SIGNAL ARRANGEMENT

LM	SIGNAL ARRANGEMENT FIGURE
1	4A
2	4A
3	4A

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			TIMING
2	GG 1523	5	+28 VDC LGC OPER GG 1523
3	GG 1513	5	+28 VDC IMU STBY GG 1513
4	GL 0801 *		1024 TIMING PCM GL 0801
5	NG 1522	4	+28 VDC LGC NOISE PK NG 1522
6	NG 1022	4	+14 VDC LGC NOISE PK NG 1022
7	NG 1032	4	+4 VDC LGC NOISE PK NG 1032
8	NG 1512	4	+28 VDC IMU STBY NOISE NG 1512
9	NG 1502	4	+28 VDC IMU OP NOISE PK NG 1502
10	NG 1072	4	+4 VDC CDU NOISE PK NG 1072
11	GG 2302	4	IMU HEATER CUR GG 2302
12	GG 2303	4	IMU BLOWER CUR GG 2303
13	GG 9006	4	IMU TEMP OUT OF LIMITS GG 9006
14	GG 9001	5	LGC WARNING GG 9001
15	GG 9002	5	ISS WARNING GG 9002
16	GG 9003	5	PNGS CAUTION GG 9003
17	GL 4069 *		C+WE MASTER ALARM GL 4069
18			
19			
20			
21			
22	GN 7557 *	5	LR VEL DATA NO GOOD
23	GN 7584 *	4	LR MODE CONTROL
24	GN 7533 *	4	LR LGC ANT 1 POS CMD
25	GN 7576 *	4	LR ANT POS NO. 1
26	GN 7577 *	4	LR ANT POS NO. 2
27	GN 7521 *	5	LR RANGE DATA NO GOOD
28	GN 7615 *	4	RR AUTO ANG TRK EN
29	GN 7621 *	5	RR NO TRACK
30	GN 7636 *	4	RR LO SCALE FACTOR
31	GN 7637 *	4	RR PWR ON MODE SW IN LGC
32			TIMING
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

* These measurements are not controlled by this specification but are included for reference only.

EVENT RECORDER SIGNAL ARRANGEMENT

FIGURE 4A

3.8 ANALOG RECORDER SIGNAL ARRANGEMENT. The signals recorded on the Analog Recorder shall be arranged as specified in Table VIII.

TABLE VIII

ANALOG RECORDER SIGNAL ARRANGEMENT

LM	CONSOLE/PANEL		
	004A1		004A3
	Analog Module		Analog Module
	A2	A3	A2
1	Fig. 5A	Fig. 5B	Fig. 5C
2	Fig. 5A	Fig. 5B	Fig. 5C
	Fig. 5A	Fig. 5B	Fig. 5C

1	2	3
IG SERVO ERR IN PH GG 2107	IG TORQUE MTR CUR GG 2110	MG SERVO ERR IN PH GG 2137
Measurement No. GG 2107 Link No. 5	Measurement No. GG 2110 Link No. 5	Measurement No. GG 2137 Link No. 5

4	5	6
MG TORQUE MTR CUR GG 2140	OG SERVO ERR IN PH GG 2167	OG TORQUE MTR CUR GG 2170
Measurement No. GG 2140 Link No. 5	Measurement No. GG 2167 Link No. 5	Measurement No. GG 2170 Link No. 5

7	8
PIPA TEMP GG 2300	IRIG TEMP GG 2301
Measurement No. GG 2300 Link No. 5	Measurement No. GG 2301 Link No. 5

8 CHANNEL ANALOG RECORDER SIGNAL ARRANGEMENT A

FIGURE 5A

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 2220	4	IG CDU FINE ERROR GG 2220
1	2	GG 2001	5	X PIP SG OUT IN PH GG 2001
1	3	GG 1020	4	+ 14V LGC SUP GG1020
1	4	GG 3312	4	RR SHAFT CDU COARSE ER GG 3312
2	1	GG 2250	4	MG CDU FINE ERROR GG 2250
2	2			
2	3	GG 1030	4	+4V LGC SUP GG 1030
2	4	GG 3322	4	RR TRUN CDU COARSE ER GG 3322
3	1	GG 2280	4	OG CDU FINE ERROR GG 2280
3	2	GG 2021	5	Y PIP SG OUT IN PH GG 2021
3	3	GG 1070	4	+4 VDC CDU PWR SUP GG 1070
3	4	GG 3311	4	RR SHAFT CDU FINE ER GG 3311
4	1	GG 2219	5	PITCH ATT ER DAC OUT GG 2219
4	2			
4	3	GG 1201	5	IMU 28V 1% 800 CPS GG 1201
4	4	GG 3321	4	RR TRUN CDU FINE ER GG 3321
5	1	GG 2249	5	YAW ATT ER DAC OUT GG 2249
5	2	GG 2041	5	Z PIP SG OUT IN PH GG 2041
5	3	GG 1201	5	IMU .8 KC 1% 0 DEG GG1201
5	4	GG 3324	5	RR TRUN IX RES OUT SIN GG 3324
6	1	GG 2279	5	ROLL ATT ER DAC OUT GG 2279
6	2			
6	3	GG 1203	4	IMU .8 KC 5% 0 DEG GG 1203
6	4	GG 3325	5	RR TRUN IX RES OUT COS GG 3325
7	1	GG 1331	5	3.2 KC 28V SUP 1% GG 1331
7	2	GG 1040	5	+120 VDC PIPA SUP GG1040
7	3	GG 1510	4	+28V IMU STBY GG 1510
7	4	GG 3304	5	RR SHAFT IX OUT SIN GG 3304
8	1			HIGH RATE
8	2	GG 1500	4	+28V IMU OPER GG 1500
8	3	GG 1520	4	+28V LGC OPER GG 1520
8	4	GG 3305	5	RR SHAFT IX OUT COS GG 3305
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

ANALOG RECORDER SIGNAL ARRANGEMENT B

FIGURE 5B

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 2112	5	IG IX RSVR OUT SIN GG 2112
1	2	GG 2166	4	OG SERVO ERROR TOTAL GG 2166
1	3	NG 1501	4	+28V IMU OPER NOISE NG 1501
1	4	GN 7567 *	4	GAIN STATE 01 GN 7567
2	1	GG 2113	5	IG IX RSVR OUT COS GG 2113
2	2	GG 2281	4	OG CDU COARSE ERROR GG 2281
2	3	NG 1521	4	+28V LGC OPER NOISE NG 1521
2	4	GN 7568 *	4	GAIN STATE 02 GN 7568
3	1	GG 2142	5	MG IX RSVR OUT SIN GG 2142
3	2	GG 2106	4	IG SERVO ERROR TOTAL GG 2106
3	3	GG 2181	5	OG IX OUT SIN 11 DEG GG 2181
3	4	GN 7569 *	4	GAIN STATE 03 GN 7569
4	1	GG 2143	5	MG IX RSVR OUT COS GG 2143
4	2	GG 2221	4	IG CDU COARSE ERR GG 2221
4	3	GG 6020	4	PIP CAL MOD TEMP GG 6020
4	4	GN 7570 *	4	GAIN STATE 04 GN 7570
5	1	GG 2172	5	OG IX RSVR OUT SIN GG 2172
5	2	GG 2136	4	MG SERVO ERROR TOTAL GG 2136
5	3	GG 2121	5	IG IX OUT SIN 11 DEG GG 2121
5	4	GN 7647 *	4	ATM OUT SHAFT GN 7647
6	1	GG 2173	5	OG IX RSVR OUT COS GG 2173
6	2	GG 2251	4	MG CDU COARSE ERR GG 2251
6	3	GG 6021	4	PSA TEMP GG 6021
6	4	GN 7645 *	4	ATM OUT TRUN GN 7645
7	1	GG 1100	4	-28 VDC SUPPLY GG 1100
7	2	GN 7655 *	4	AC PWR 1 GN 7655
7	3	GG 2151	5	MG IX OUT SIN 11 DEG GG 2151
7	4	GN 7563 *	5	LR ANT TEMP GN 7563
8	1	GG 1110	5	2.5 VDC TM BIAS 1 GG 1110
8	2	GN 7656 *	4	AC PWR 2 GN 7656
8	3	GG 4300	4	LGC TEMP GG 4300
8	4	GN 7723 *	5	RR ANT TEMP GN 7723
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

* These measurements are not controlled by this specification but are included for reference only.

ANALOG RECORDER SIGNAL ARRANGEMENT C

FIGURE 5C

3.9 **R-START SIGNAL ARRANGEMENT.** The R-START signal arrangement for each LM shall be as specified in Table IX.

TABLE IX

R-START SIGNAL

ARRANGEMENT

LM	CONSOLE/PANEL	
	004A2	004A4
	Module A06	Module A05
2	Figure 6B	Figure 6A

4A4A05

R-START 144				R-START 145			
			CRT ERROR RESET DG 0000	LGC DISPLAY PROGRAM DG 0001		LGC DISPLAY RECORD	
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START 146				R-START 147			
K-START DUMP DG 0004	K-START VERIFY DG 0003	K-START LOAD- VERIFY DG 0002		PIPA REF SELECT DG 2501	X PIPA SELECT DG 2502	Y PIPA SELECT DG 2503	Z PIPA SELECT DG 2504
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START SIGNAL ARRANGEMENT A

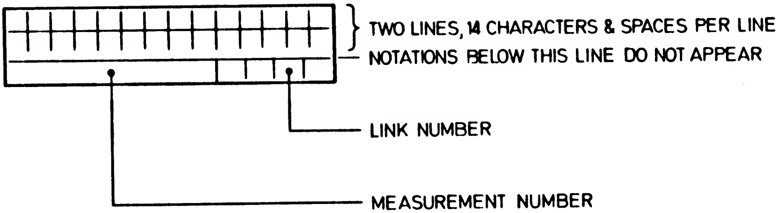
FIGURE 6A

R-START 152				R-START 153			
	LGC TIME TRANS- MISSION DG 0007	LGC TIME CORRECTION DG 0006	LGC CLOCK INITIALI- ZATION DG 0005				
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

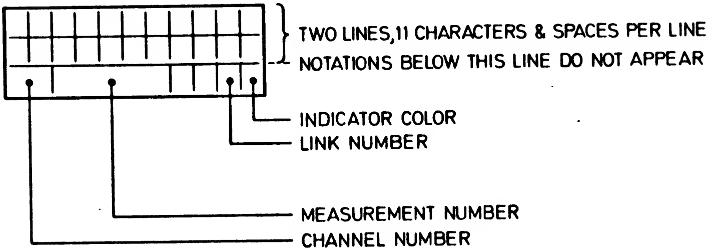
R-START 154				R-START 155			
4 VDC SUPPLY LO WG 0023	4 VDC SUPPLY HI JG 0023	14 VDC SUPPLY LO WG 0022	14 VDC SUPPLY HI JG 0022	IG STEP INPUT JG 2505	MG STEP INPUT JG 2506	OG STEP INPUT JG 2507	LGC MARGIN TEST ENABLE JG 0021
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START SIGNAL ARRANGEMENT B

FIGURE 6B


TWO LINES, 14 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
LINK NUMBER
MEASUREMENT NUMBER

7 A. - METER IDENTIFICATION INSERT


TWO LINES,11 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
INDICATOR COLOR
LINK NUMBER
MEASUREMENT NUMBER
CHANNEL NUMBER

7 B. - EVENT INDICATOR DISPLAY FORMAT

FIGURE 7

3.10 C-START. - The C-START arrangement for each LM shall be as specified in Table X.

TABLE X

C-START

CODE NO.	STIMULUS NO.	CODE NO.	STIMULUS NO.	CODE NO.	STIMULUS NO.
1	DG 0009				
2	DG 9102				
3	ZG 0022				
4	ZG 0023				

CODE NO.	SUB-PROGRAM	C-START ENTRY
31	G&N 631	00000XXX
20	G&N 641	XX000000
	G&N 601 CODES 90, 91, 70, 80, 71	XXXXXXXX

4. QUALITY ASSURANCE PROVISIONS

4.1 INSPECTION. The requirements specified in Section 3 shall be verified by visual inspection.

5. PREPARATION FOR DELIVERY. This section is not applicable to this specification.

6. NOTES.

6.1 VARIATIONS TO SIGNAL ARRANGEMENT. Signal arrangements within a display module or assembly may be varied, but the signals shall be retained by the original module or assembly specified. The signal arrangement for the CRT display (3.4) shall be restricted to variations within the half page specified.

APOLLO G&N Specification
ND1002322 REV B
Original Issue Date:
Release Authority: TDRR 31355
Class A Release
CODE IDENT NO. 99974

G&N PROGRAMMING REQUIREMENTS
(DISPLAYS & CONTROLS)
FOR
ACCEPTANCE CHECKOUT EQUIPMENT
(LM)

Record of Revisions

	Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
Ⓜ						NASA
Ⓜ	10/27/66	A	31659	3-33. Was 33 pages, now	EA	WLS
				36 pages.		
Ⓜ	11/15/66	B	31947	2-49 was 36 pages, now 49 pages	EA	- -

This specification consists of page 1 to 49 inclusive.

APPROVALS	NASA/MSC				AC

1. SCOPE

1.1 PURPOSE. This specification establishes the G&N programming requirements for signal arrangements displays, and limits during post-installation checkout of a Lunar Module (LM) using Acceptance Checkout Equipment (ACE). (See 6.1, 6.2, and 6.3).

2. APPLICABLE DOCUMENTS

2.1 EFFECTIVE ISSUES. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, Military Standards and Specifications shall be that issue in effect on the date of request for proposal or invitation to bid.

SPECIFICATIONS

APOLLO G&N

ND1002319	ACE-S/C Computer Subprogram Specification for APOLLO CM and LM G&N Testing

(Copies of specifications, standards, drawings, bulletins, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 CONFLICTING REQUIREMENTS. In the event of a conflict between requirements, the following order of precedence shall apply.

a. The contract.
b. This specification.
c. Documents listed in this specification.

3. REQUIREMENTS

3.1 G&N LM SUBPROGRAMS. The subprograms contained in Specification ND1002319 shall be used for the applicable LM configuration as specified in Table I.

TABLE I

SUBPROGRAMS

LM VEHICLE (Use Subprogram Indicated with "X")	AC ELECTRONICS G&N SUBPROGRAMS													
	601	602	603	621	622	624A	624B	631	632	641	652	653	671	681
LTA8-M	X	X	X	X	X	X		X	X				X	
LM1-G	X	X	X	X	X	X		X	X	X	X	X	X	X
LM1-K	X	X	X	X	X		X	X	X	X	X	X	X	X
LM2-G	X	X	X	X	X	X		X	X	X	X	X	X	X
LM2-K	X	X	X	X	X		X	X	X	X	X	X	X	X
LM3-	X	X	X	X	X		X	X	X	X	X	X	X	X

3.2 SIGNAL BLINK LIMITS. The following signal blink limits shall apply to all G&N LM.

a. The following signals shall have blink limits equal to tolerances specified in the applicable LM Operational Checkout Procedure.

GG 1020
GG 1030
GG 1040
GG 1070
GG 1100

GG 1110

GG 1201
GG 1202
GG 1203

GG 1331
NG 1336
GG 1500
GG 1510
GG 1520

b. The following signals shall have blink limits of ±4095:

NG 1021
NG 1031
NG 1071
NG 1501
NG 1511
NG 1521
GG 2001
GG 2021
GG 2041
GG 2106
GG 2107
GG 2110
GG 2121
GG 2136
GG 2137
GG 2140
GG 2151
GC 2166
GG 2167
GG 2170
GG 2181
GG 2219
GG 2220
GG 2221
GG 2249
GG 2250
GG 2251
GG 2279
GG 2280
GG 2281
GG 2300
GG 2301
GG 3304
GG 3305
GG 3324
GG 3325
GG 3311
GG 3312
GG 3321
GG 3322
GG 4300
GG 6020
GG 6021
GG 2112
GG 2113
GG 2142
GG 2143
GG 2172
GG 2173
GG 8102
GG 8103
GG 8104
GG 8105
GG 8106
GG 8107
GG 8108
GG 8109
GG 8110
GG 8111
GG 8112
GG 8113
GG 8114
GG 8115
GG 8116
GG 8117

3.3 HIGH RATE MEASUREMENTS. The C START Panel shall program the signals specified in Table II.

TABLE II

HIGH RATE MEASUREMENTS*

SIGNAL PROGRAMMED MEAS NO.
GG 2106
↑ 2110
2136
2140
2166
2170
2220
2250
2280
↓ 2311
GG 3321

*Not applicable to LTA8-M

3.4 CRT DISPLAYS. The CRT screen on the CRT module shall display information for each LM in accordance with Table III.

TABLE III

LM/CRT DISPLAY

LM	CRT DISPLAY FORMAT FIGURE
1	1A 1B 1C 1D 1E
2	1A, 1B, 1C, 1D, 1E, . .
3	1A 1B 1C 1D 1E
LTA8-M	1C, 1F, 1G, 1H, 1J

3.4.1 Measurement Numbers. Table IV correlates the signal measurement numbers to the scope spacing chart displays and indicates location of measurement within the display.

TABLE IV

CRT DISPLAY ASSIGNMENT MEASUREMENT LIST*

SIGNAL NUMBER	CRT FIG-LINE
GG 1020	1A-15
1030	1A-16
1040	1A-20, 1G-21
1070	1A-19
1100	1A-21
1110	1A-22, 1G-20
1201	1A-21, 1G-21
1202	1A-22
1203	1A-23
1331	1A-24, 1G-20
1500	1A-18
1510	1A-17
1520	1A-14
2001	1B-3, 1G-8
2021	1B-3, 1G-8
2041	1B-3, 1G-8
2106	1B-5
2107	1B-6, 1G-7
2110	1B-4, 1G-6
2112	1B-7, 1G-4
2113	1B-8, 1G-5
2112/2113 **	1B-15
2121	1B-17, 1G-3
2136	1B-5
2137	1B-6, 1G-7
2140	1B-4, 1G-6
2142	1B-7, 1G-4
2143	1B-8, 1G-5
2142/2143 **	1B-15
2151	1B-17, 1G-3
2166	1B-5
2167	1B-6, 1G-7
2170	1B-4, 1G-6
2172	1B-7, 1G-4
2173	1B-8, 1G-5
2172/2173 **	1B-15
2181	1B-17, 1G-3
GG 2219	1B-16, 1G-12
2220	1B-10, 1G-5
2221	1B-9
2249	1B-16, 1G-12
2250	1B-10, 1G-5
2251	1B-9
2279	1B-16, 1G-12
2280	1B-10, 1G-5
2281	1B-9
2300	1B-24, 1G-24
2301	1B-24, 1G-24
3304	1E-2, 1F-2
3305	1E-3, 1F-3
3304/3305 ***	1E-4
3311	1E-6, 1F-5
3312	1E-7
3321	1E-6, 1F-5
3322	1E-7
3324	1E-2, 1F-2
3325	1E-3, 1F-3
3324/3325 ***	1E-4
4300	1E-21, 1G-22+
6020	1E-21, 1G-23
GG 6021	1E-21, 1G-23+
NG 1021	1A-15
1031	1A-16
1071	1A-19
1336	1A-24
1501	1A-18
1511	1A-17
NG 1521	1A-14
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

NOTE: * Whenever a choice between LINK 4 or LINK 5 exists, use LINK 5

** Processed by G&N 652

*** Processed by G&N 653

+ Supplementary measurement, LTA8-M only.

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1		L	R		A	L	T		D		O	K			X	X			R	R		O	N	/	A	U	T	O							X	X		
2	0	2		L	R	A	L	T		L	O	-	S	C			X	X			R	R		R	A	N	G	E		L	O	-	S	C			X	X		
3	0	3		L	R		V	E	L		D		O	K			X	X			R	R		D	A	T	A		G	O	O	D					X	X		
4	0	4		L	R		V	E	L		F	A	I	L			X	X			R	R		D	A	T	A		F	A	I	L					X	X		
5	0	5		L	R		P	O	S	2		C	M	D			X	X			R	R		L	O	C	K	O	N		A	B	L				X	X		
6	0	6		L	R		P	O	S		1						X	X			R	R		A	N	T		O	U	T							X	X		
7	0	7		L	R		P	O	S		2						X	X			R	R		A	N	T		M	O	D	E						X	X		
8	0	8		L	R		A	L	T		F	A	I	L			X	X			R	R		A	N	T		R	E	M	D						X	X		
9	0	9		F	O	R	V	E	L		X	X	X	.	X	X		F	P	S		L	A	T	V	E	L			X	X	X	.	X	X		F	P	S	
10	1	0		A	L	T		R	A	T	E				X	X	X	X	.	X		F	P	S																
11	1	1		H	O	R	I	Z		V	E	L					X	X			A	L	T		R	A	T	E		S	E	L					X	X		
12	1	2		R	R		E	R		C	T	R					X	X			A	L	T		M	E	T	E	R		A	C	T				X	X		
13		G	G				S	U	P	P	L	Y					V	D	C			N	G				N	O	I	S	E					V	R	M	S	
14	1	5	2	0		+	2	8		L	G	C				X	X	.	X		1	5	2	1		+	2	8		L	G	C				X	.	X	X	
15	1	0	2	0		+	1	4		L	G	C				X	X	.	X		1	0	2	1		+	1	4		L	G	C				X	.	X	X	
16	1	0	3	0		+		4		L	G	C				X	.	X	X		1	0	3	1		+		4		L	G	C				X	.	X	X	
17	1	5	1	0		+	2	8		S	B	Y				X	X	.	X		1	5	1	1		+	2	8		S	B	Y				X	.	X	X	
18	1	5	0	0		+	2	8		O	P	R				X	X	.	X		1	5	0	1		+	2	8		O	P	R				X	.	X	X	
19	1	0	7	0		+		4		C	D	U				X	.	X	X		1	0	7	1		+		4		C	D	U				X	.	X	X	
20	1	0	4	0		1	2	0		P	I	P					X	X	X			G	G				S	U	P	P	L	Y				V	R	M	S	
21	1	1	0	0		-	2	8		S	U	P			-	X	X	.	X		1	2	0	1		I	M	U		1	%	0				X	X	.	X	
22	1	1	1	0		T	M		B	I	A	S				X	.	X	X		1	2	0	2		I	M	U		5	%	0				X	X	.	X	
23		N	G			P	H		D	I	F						D	E	G		1	2	0	3		I	M	U		5	%	0				X	X	.	X	
24	1	3	3	6		3	.	2	/	L	G	C				X	X	X			1	3	3	1		2	8	V	3	.	2	H				X	X	.	X	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT A

FIGURE 1A

SCOPE SPACING CHART
FOR PAGE DISPLAY

AA																																								
1	0	1			I	S	S		M	E	A	S					X	/	O	G					Y	/	I	G				Z	/	M	G					
2	0	2		P	I	P	A		C	T	R					X	X	X	X	X			X	X	X	X	X			X	X	X	X	X						
3	0	3		P	I	P	A		S	G		0						X	.	X	X				X	.	X	X				X	.	X	X					
4	0	4		T	O	R		M	O	T		C	U	R				.	X	X	X				.	X	X	X				.	X	X	X		A	M	P	S
5	0	5		S	E	R	V	O		E	R		T	L				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
6	0	6		S	E	R	V	O		E	R		0					X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
7	0	7		1	X		R	S	V	R		S	I	N				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S
8	0	8		1	X		R	S	V	R		C	O	S				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S
9	0	9		C	D	U		C	R	S		E	R	R				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
10	1	0		C	D	U		F	I	N		E	R	R				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
11	1	1																																						
12	1	2																																						
13	1	3			I	S	S		M	E	A	S			X	/	Y	A	W			Y	/	P	I	T	C	H			Z	/	R	O	L	L				
14	1	4		C	D	U		A	N	G	L	E				X	X	X	.	X	X		X	X	X	.	X	X		X	X	X	.	X	X			D	E	G
15	1	5		G	I	M	B		A	N	G	L	E					X	X	X					X	X	X					X	X	X				D	E	G
16	1	6		D	A	C		A	T	T		E	R					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G
17	1	7		I	X		S	I	N		1	1	•					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G
18	1	8		I	M	U		O	P	E	R						X	X			I	S	S		T	R	N	O	N		R	Q	S	T			X	X		
19	1	9		I	M	U		C	A	G	E						X	X			I	S	S		T	R	N	O	N		C	O	M	P			X	X		
20	2	0		C	D	U		C	O	N	T	R	O	L			X	X			I	N	I	T	I	A	L	I	Z	E		I	S	S			X	X		
21	2	1		C	O	R	S	E		A	L	I	G	N			X	X			D	S	P		I	N	R	T	L		D	A	T	A			X	X		
22	2	2		Z	E	R	O		I	C	D	U					X	X			I	S	S		E	R	R		C	T	R						X	X		
23	2	3		T	E	M	P		I	N		L	I	M			X	X			N	O		A	T	T	I	T	U	D	E						X	X		
24	2	4		P	I	P	A		T	E	M	P			X	X	X	.	X		•	F		I	R	I	G		T	E	M	P		X	X	X	.	X	•	F
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT B

FIGURE 1B

SCOPE SPACING CHART FOR PAGE DISPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
AA																																									
1	0	1					A	C	T	I	V	I	T	Y							P	R	O	G	R	A	M				V	E	R	B		N	O	U	N		
2	0	2		U	P	L	I	N	K		C	O	M	P	U	T	E	R					X	X								X	X				X	X			
3	0	3		I	S	S		M	O	D	E		X	X	X	X	X	X											R	1			X	X	X	X	X				
4	0	4		I	N	H	I	B		U	P	L	I	N	K		X	X											R	2			X	X	X	X	X				
5	0	5		B	L	O	C	K		U	P	L	I	N	K		X	X											R	3			X	X	X	X	X				
6	0	6		U	P	L	O	C	K								X	X			K	E	Y		R	E	L	E	A	S	E						X	X			
7	0	7		U	P	L	N	K		F	A	S	T				X	X			O	P	E	R	A	T	O	R		E	R	R					X	X			
8	0	8		G	I	M	B	A	L		L	O	C	K			X	X			P	R	O	G	R	A	M			A	L	M					X	X			
9	0	9		I	M	U					F	A	I	L			X	X			T	E	M	P		C	A	U	T	I	O	N					X	X			
10	1	0		P	I	P	A				F	A	I	L			X	X			R	E	D	O	C	T	R						X	X	X	X	X				
11	1	1		I	S	S	C	D	U		F	A	I	L			X	X			L	M	P	C	M	D							X	X	X	X	X				
12	1	2		R	R		C	D	U		F	A	I	L			X	X			F	A	I	L	R	E	G						X	X	X	X	X				
13	1	3		W	O	R	D		E	R	R		X	X	X	X	X	X	X		O	S	C		A	L	A	R	M								X	X			
14	1	4		S	Y	N	C		E	R	R						X	X			T	R	A	C	K	E	R		F	A	I	L					X	X.			
15	1	5		R	E	L			E	R	R						X				T	E	S	T		A	L	A	R	M	S						X	X			
16	1	6		K	E	Y			E	R	R						X	X			A	B	L		L	G	C		S	T	B	Y					X	X			
17	1	7		P	A	R			E	R	R						X				P	I	P	A		M	E	A	S								X	X	X		**
18	1	8		V	E	R			E	R	R		X	X	X	X	X				H	I		R	A	T	E							G	G	X	X	X	X		**
19	1	9		K	S	E	Q						O	K							I	G	N	I	C	D	U		F	A	I	L					X	X			
20	2	0		I	G	N	P	I	P		F	A	I	L			X	X			I	G	N	R	C	D	U		F	A	I	L					X	X			
21	2	1		I	G	N	I	M	U		F	A	I	L			X	X			T	I	M	E		E	R	R	O	R			X	X	X	X					
22	2	2		Δ	T	I	M	E		X	X	X	.	X	X	X	S	E	C		F	S				E	R	R	O	R			X								**
23	2	3		T	I	M	E		E	P				X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X	X		S	E	C		*
24	2	4		L	G	C		T	I	M	E			X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X			S	E	C		
25																																									

* TIME EP = "TIME EPOCH" OR "TIME EPHEMERIS," WHICHEVER APPLICABLE.

** No FS error display required if ADAP routine for subprogram 681, N/A for LTA8-M

CRT DISPLAY

FORMAT C

FIGURE 1C

SCOPE SPACING CHART
FOR PAGE DISPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
AA																																								
1	0	1		+	Y	M	I										X	X			J	E	T	S		2	-	4		F	A	I	L				X	X		
2	0	2		-	Y	M	I										X	X			J	E	T	S		5	-	8		F	A	I	L				X	X		
3	0	3		+	E	L	L	P	D	/	+	P	M	I			X	X			J	E	T	S		1	-	3		F	A	I	L				X	X		
4	0	4		-	E	L	L	P	D	/	-	P	M	I			X	X			J	E	T	S		6	-	7		F	A	I	L				X	X		
5	0	5		+	A	Z	L	P	D	/	+	R	M	I			X	X			J	E	T	S		1	4	-	1	6		F	L				X	X		
6	0	6		-	A	Z	L	P	D	/	-	R	M	I			X	X			J	E	T	S		1	3	-	1	5		F	L				X	X		
7	0	7		+	X		T	R	A	N	S						X	X			J	E	T	S		9	-	1	2			F	L				X	X		
8	0	8		-	X		T	R	A	N	S						X	X			J	E	T	S		1	0	-	1	1		F	L				X	X		
9	0	9		+	Y		T	R	A	N	S						X	X			P	G	N	C	S		C	O	N	T		L	M				X	X		
10	1	0		-	Y		T	R	A	N	S						X	X			A	T	T	I	T	U	D	E		H	O	L	D				X	X		
11	1	1		+	Z		T	R	A	N	S						X	X			A	U	T	O		S	T	A	B								X	X		
12	1	2		-	Z		T	R	A	N	S						X	X			A	T	T		C	O	N	T		D	E	T					X	X		
13	1	3		E	N	G	I	N	E		O	N					X	X			P	I	T	C	H		G	I	M	B		O	F	F			X	X		
14	1	4		E	N	G	I	N	E		O	F	F				X	X			R	O	L	L			G	I	M	B		O	F	F			X	X		
15	1	5		+	P	I	T	C	H		T	R	I	M			X	X			E	N	G	I	N	E		A	R	M	E	D					X	X		
16	1	6		-	P	I	T	C	H		T	R	I	M			X	X			S	T	A	G	E		V	E	R	I	F						X	X		
17	1	7		+	R	O	L	L			T	R	I	M			X	X			A	B	O	R	T		S	T	A	G	E						X	X		
18	1	8		-	R	O	L	L			T	R	I	M			X	X			A	B	O	R	T												X	X		
19	1	9		A	U	T	O		T	H	R	O	T				X	X			T	H	R	U	S	T		D	R	V							X	X		
20	2	0																																						
21	2	1			L	R		A	L	T		F	T										X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
22	2	2			L	R		V	X			F	P	S									X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
23	2	3			L	R		V	Y			F	P	S									X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
24	2	4			L	R		V	Z			F	P	S										X	X	X	X	X	X	X	X	.	X	X	X	X	X			
25																																								

CRT DISPLAY

FORMAT D

FIGURE 1D

SCOPE SPACING CHART
FOR PAGE DISPLAY

AA																																								
1		R	R		S	H	A	F	T														R	R			T	R	U	N	N	I	O	N						
2	0	2		1	X		S	I	N		V	R	M	S		X	X	.	X		1	X		S	I	N		V	R	M	S		X	X	.	X				
3	0	3		1	X		C	O	S		V	R	M	S		X	X	.	X		1	X		C	O	S		V	R	M	S		X	X	.	X				
4	0	4		A	N	G	L	E				D	E	G			X	X	X		A	N	G	L	E			D	E	G		∠	X	X	X					
5	0	5		C	D	U		∠		D	E	G		X	X	X	.	X	X		C	D	U		∠		D	E	G		X	X	X	.	X	X				
6	0	6		F	I	N		E	R		V	R	M	S		X	.	X	X		F	I	N	E		E	R		V	R	M	S		X	.	X	X			
7	0	7		C	R	S		E	R		V	R	M	S		X	.	X	X		C	R	S			E	R		V	R	M	S		X	.	X	X			
8	0	8		A	L	T	S	A	V	E			D	P											X	X	X	X	X	X	X	.	X	X	X		F	E	E	T
9	0	9		F	I	N	A	L	T				D	P											X	X	X	X	X	X	X	.	X	X	X		F	E	E	T
10	1	0		R	R		R	A	N	G	E												X	X	X	X	X	X	X	X	X	X	.	X	X	X		F	T	
11	1	1		R	R		R	A	N	G	E		R	A	T	E							X	X	X	X	X	X	X	X	X	.	X	X	X	X		F	P	S
12	1	2		Z	E	R	O		R	R		C	D	U			X	X			C	O	N	T		D	E	S	I	G							X	X		
13																																								
14																																								
15																																								
16																																								
17																																								
18																																								
19																																								
20																L	G	C				C	A	L		M	O	D			P	S	A							
21	2	1		T	E	M	P	E	R	A	T	U	R	E		X	X	X						X	X	X					X	X	X				D	E	G	F
22	2	2		A	N	G	X	/	P	I	P	E		X	X	X	X	X				V	D	R	I	F	T	O	±	X	X	X	.	X	X		M	E	R	U
23	2	3		A	N	G	Y	/	P	I	P	N		X	X	X	X	X				S	D	R	I	F	T	I	±	X	X	X	.	X	X		M	E	R	U
24	2	4		A	N	G	Z						±	X	X	X	X	X				E	D	R	I	F	T	T	±	X	X	X	.	X	X		M	E	R	U
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT E

FIGURE 1E

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1		R	R		S	H	A	F	T														R	R		T	R	U	N	N	I	O	N							
2	0	2		1	X		S	I	N		V	R	M	S		X	X	.	X		1	X		S	I	N		V	R	M	S					X	X	.	X	
3	0	3		1	X		C	O	S		V	R	M	S		X	X	.	X		1	X		C	O	S		V	R	M	S					X	X	.	X	
4	0	4		L	R		A	L	T		F	T											X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
5	0	5		L	R		V	X			F	P	S										X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
6	0	6		L	R		V	Y			F	P	S										X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
7	0	7		L	R		V	Z			F	P	S											X	X	X	X	X	X	X	X	.	X	X	X	X	X			
8	0	8		A	L	T	S	A	V	E			D	P											X	X	X	X	X	X	X	.	X	X	X		F	E	E	T
9	0	9		F	I	N	A	L	T				D	P											X	X	X	X	X	X	X	.	X	X	X		F	E	E	T
10	1	0		R	R		R	A	N	G	E											X	X	X	X	X	X	X	X	X	X	.	X	X	X		F	E	E	T
11	1	1		R	R		R	A	N	G	E		R	A	T	E						X	X	X	X	X	X	X	X	X	X	.	X	X	X		F	P	S	
12	1	2		C	O	N	T		D	E	S	I	G				O	X	X		Z	E	R	O		R	R		C	D	U						O	X	X	
13	1	3		L	R		A	L	T		D		O	K			O	X	X		R	R		O	N	/	A	U	T	O							O	X	X	
14	1	4		L	R	A	L	T		L	O	-	S	C			O	X	X		R	R		R	A	N	G	E		L	O	-	S	L			O	X	X	
15	1	5		L	R		V	E	L		D		O	K			O	X	X		R	R		D	A	T	A		G	O	O	D					O	X	X	
16	1	6		L	R		V	E	L		F	A	I	L			O	X	X		R	R		D	A	T	A		F	A	I	L					O	X	X	
17	1	7		L	R		P	O	S	2		C	M	D			O	X	X		R	R		L	O	C	K	O	N		A	B	L				O	X	X	
18	1	8		L	R		P	O	S		1						O	X	X		R	R		A	N	T		O	U	T							O	X	X	
19	1	9		L	R		P	O	S		2						O	X	X		R	R		A	N	T		M	O	D	E						O	X	X	
20	2	0		L	R		A	L	T		F	A	I	L			O	X	X		R	R		A	N	T		R	E	M	D						O	X	X	
21	2	1		F	O	R	V	E	L		X	X	X	.	X	X		F	P	S		L	A	T	V	E	L			X	X	X	.	X	X		F	P	S	
22	2	2		A	L	T		R	A	T	E				X	X	X	X	.	X		F	P	S																
23	2	3		H	O	R	I	Z		V	E	L					O	X	X		A	L	T		R	A	T	E		S	E	L					O	X	X	
24	2	4		R	R		E	R		C	T	R					O	X	X		A	L	T		M	E	T	E	R		A	C	T				O	X	X	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT F

FIGURE 1F

SCOPE SPACING CHART
FOR PAGE DISPLAY

AA																																								
1	0	1			I	S	S		M	E	A	S						X	/	O	G				Y	/	I	G				Z	/	M	G					
2	0	2		C	D	U		A	N	G	L	E				X	X	X	.	X	X		X	X	X	.	X	X		X	X	X	.	X	X			D	E	G
3	0	3		1	X		S	I	N		1	1	°					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G
4	0	4		1	X		R	S	V	R		S	I	N				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S
5	0	5		1	X		R	S	V	R		C	O	S				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S
6	0	6		T	O	R		M	O	T		C	U	R				.	X	X	X				.	X	X	X				.	X	X	X		A	M	P	S
7	0	7		S	E	R	V	O		E	R		ø					X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
8	0	8		P	I	P	A		S	G		ø						X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
9	0	9		P	I	P	A		C	T	R						X	X	X	X	X			X	X	X	X	X			X	X	X	X	X					
10	1	0																																						
11	1	1			I	S	S		M	E	A	S					X	/	Y	A	W		Y	/	P	I	T	C	H		Z	/	R	O	L	L				
12	1	2		D	A	C		A	T	T		E	R					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G
13	1	3		T	E	M	P		I	N		L	I	M			O	X	X		I	M	U		O	P	E	R	A	T	E						O	X	X	
14	1	4		Z	E	R	O		I	C	D	U					O	X	X		I	S	S		T	R	N	O	N		R	Q	S	T			O	X	X	
15	1	5		I	N	I	T		I	S	S						O	X	X		I	S	S		T	R	N	O	N		C	O	M	P			O	X	X	
16	1	6		I	M	U		C	A	G	E						O	X	X		C	D	U		C	O	N	T	R	O	L						O	X	X	
17	1	7		I	S	S		E	R	R		C	T	R			O	X	X		D	S	P		I	N	R	T	L		D	A	T	A			O	X	X	
18	1	8		C	O	R	S	E		A	L	I	G	N			O	X	X		N	O		A	T	T	I	T	U	D	E						O	X	X	
19		G	G				S	U	P	P	L	Y					V	D	C			G	G				S	U	P	P	L	Y				V	R	M	S	
20	1	1	1	0		T	M		B	I	A	S				X	.	X	X		1	3	3	1		2	8	V	3	.	2	K	C			X	X	.	X	
21	1	0	4	0		1	2			P	I	P				X	X	X			1	2	0	1		I	M	U		1	%	0				X	X	.	X	
22	4.	3	0	0		L	G	C		T	E	M	P		X	X	X	.	X		°	F																		
23	6	0	2	1		P	S	A		T	E	M	P		X	X	X	.	X		°	F		P	I	P		C	A	L		M	O	D		X	X	X	°	F
24	2	4		I	R	I	G		T	E	M	P				X	X	X	,	X	°	F		P	I	P	A		T	E	M	P		X	X	X	,	X	°	F
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT G

FIGURE 1G

SCOPE SPACING CHART FOR PAGE DISPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
AA																																								
1	0	1		+	Y	M	I										O	X	X		J	E	T	S		2	-	4		F	A	I	L				O	X	X	
2	0	2		-	Y	M	I										O	X	X		J	E	T	S		5	-	8		F	A	I	L				O	X	X	
3	0	3		+	E	L	L	P	D	/	+	P	M	I			O	X	X		J	E	T	S		1	-	3		F	A	I	L				O	X	X	
4	0	4		-	E	L	L	P	D	/	-	P	M	I			O	X	X		J	E	T	S		6	-	7		F	A	I	L				O	X	X	
5	0	5		+	A	Z	L	P	D	/	+	R	M	I			O	X	X		J	E	T	S		1	4	-	1	6		F	L				O	X	X	
6	0	6		-	A	Z	L	P	D	/	-	R	M	I			O	X	X		J	E	T	S		1	3	-	1	5		F	L				O	X	X	
7	0	7		+	X		T	R	A	N	S						O	X	X		J	E	T	S			9	-	1	2		F	L				O	X	X	
8	0	8		-	X		T	R	A	N	S						O	X	X		J	E	T	S		1	0	-	1	1		F	L				O	X	X	
9	0	9		+	Y		T	R	A	N	S						O	X	X		P	G	N	S		C	O	N	T		L	E	M				O	X	X	
10	1	0		-	Y		T	R	A	N	S						O	X	X		A	T	T	I	T	U	D	E		H	O	L	D				O	X	X	
11	1	1		+	Z		T	R	A	N	S						O	X	X		A	U	T	O		S	T	A	B								O	X	X	
12	1	2		-	Z		T	R	A	N	S						O	X	X		A	T	T		C	O	N	T		D	E	T					O	X	X	
13	1	3		E	N	G	I	N	E		O	N					O	X	X		P	I	T	C	H		G	I	M	B		O	F	F			O	X	X	
14	1	4		E	N	G	I	N	E		O	F	F				O	X	X		R	O	L	L			G	I	M	B		O	F	F			O	X	X	
15	1	5		+	P	I	T	C	H		T	R	I	M			O	X	X		E	N	G	I	N	E		A	R	M	E	D					O	X	X	
16	1	6		-	P	I	T	C	H		T	R	I	M			O	X	X		S	T	A	G	E		V	E	R	I	F						O	X	X	
17	1	7		+	R	O	L	L			T	R	I	M			O	X	X		A	B	O	R	T		S	T	A	G	E						O	X	X	
18	1	8		-	R	O	L	L			T	R	I	M			O	X	X		A	B	O	R	T												O	X	X	
19	1	9		A	U	T	O		T	H	R	O	T				O	X	X		T	H	R	U	S	T		D	R	V							O	X	X	
20	2	0		A	N	G	X	/	P	I	P	E			X	X	X	X	X		V	D	R	I	F	T	O			X	X	X	.	X	X		M	E	R	U
21	2	1		A	N	G	Y	/	P	I	P	N			X	X	X	X	X		S	D	R	I	F	T	I			X	X	X	.	X	X		M	E	R	U
22	2	2		A	N	G	Z								X	X	X	X	X		E	D	R	I	F	T	T			X	X	X	.	X	X		M	E	R	U
23																																								
24																																								
25																																								

CRT DISPLAY

FORMAT H

FIGURE 1H

SCOPE SPACING CHART FOR PAGE DISPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
AA																																								
1	G	G	8	1			T		T	E	M	P			D	E	G	F		G	G	8	1			T		T	E	M	P					D	E	G	F	
2	0	2		I	M	U		P	A	D		A	V	E		X	X	X		1	3		C	D	U		T	R	A	Y		X	4	V			X	X	X	
3	0	3		I	M	U		C	O	O	L		I	N			X	X		1	4		C	D	U		T	R	A	Y		X	F	L			X	X	X	
4	0	4		P	T	A		H	D	R		P	C	M		X	X	X		1	5		C	D	U		T	R	A	Y		X	F	R			X	X	X	
5	0	5		P	T	A		H	D	R		P	T	S		X	X	X		1	6		A	O	T		E	X	T		L	E	N	S			X	X	X	
6	0	6		P	T	A		H	D	R		B	C	S		X	X	X		1	7		A	O	T		E	X	T		P	R	S	L			X	X	X	
7	0	7		L	G	C		L	O	C		1				X	X	X																						
8	0	8		L	G	C		L	O	C		2				X	X	X																						
9	0	9		L	G	C		L	O	C		3				X	X	X																						
10	1	0		P	S	A		H	D	R		P	H	A		X	X	X																						
11	1	1		P	S	A		H	D	R		P	H	B		X	X	X																						
12	1	2		P	S	A		H	D	R		G	S	A		X	X	X																						
13																																								
14																																								
15																																								
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22																																								
23																																								
24																																								
25																																								

CRT DISPLAY
FORMAT J

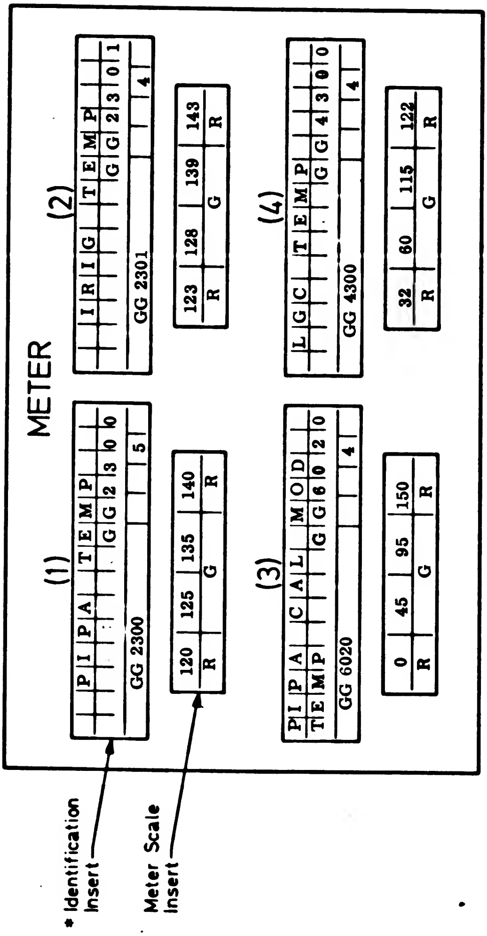
FIGURE 1J

3.5 METER DISPLAYS. The meter display format assignment for each LM shall be as specified in Table V. Meter scaling and color band coding are specified for reference and are subject to change by the user.

TABLE V

METER DISPLAYS

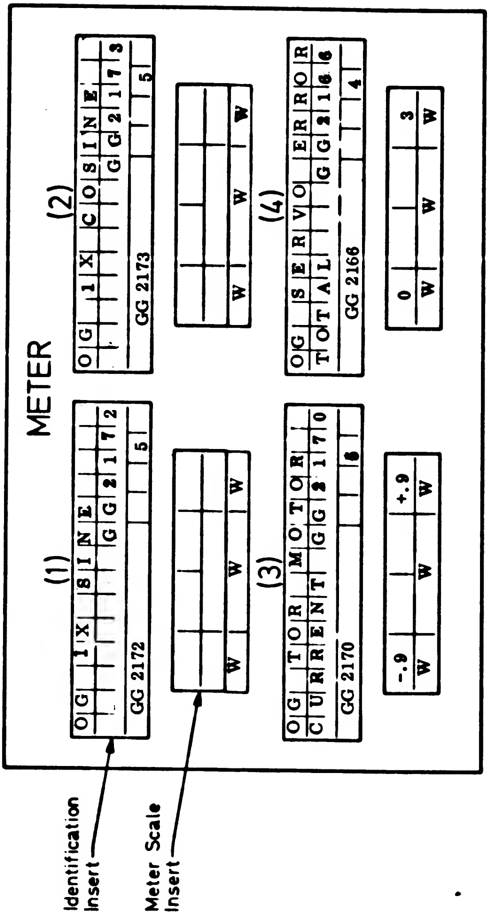
LM	Console Panel							
	004A2		004A3				014A1	
	Meter Module		Meter Module				Meter Module	
	A3 Figure	A4 Figure	A6 Fig.	A7 Fig.	A8 Fig.	A9 Fig.	A3 Figure	A4 Figure
1	2A	2B	2C	2D	2E	2G	2H	2F
2	2A	2B	2C	2D	2E	2G	2H	2F
3	2A	2B	2C	2D	2E	2G	2H	2F
LTA8-M	2J		2M	2D	2K	2L	2H	2N



* See Figure 7A

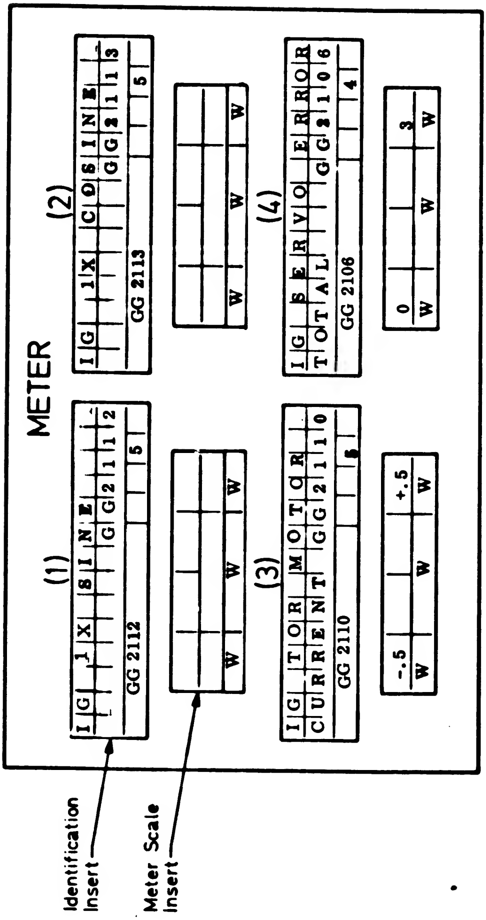
METER DISPLAY A

FIGURE 2A



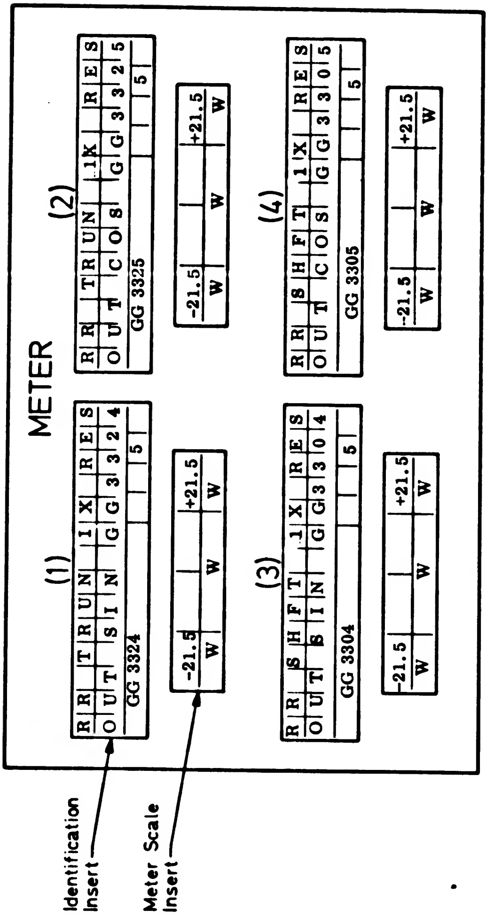
METER DISPLAY B

FIGURE 2B



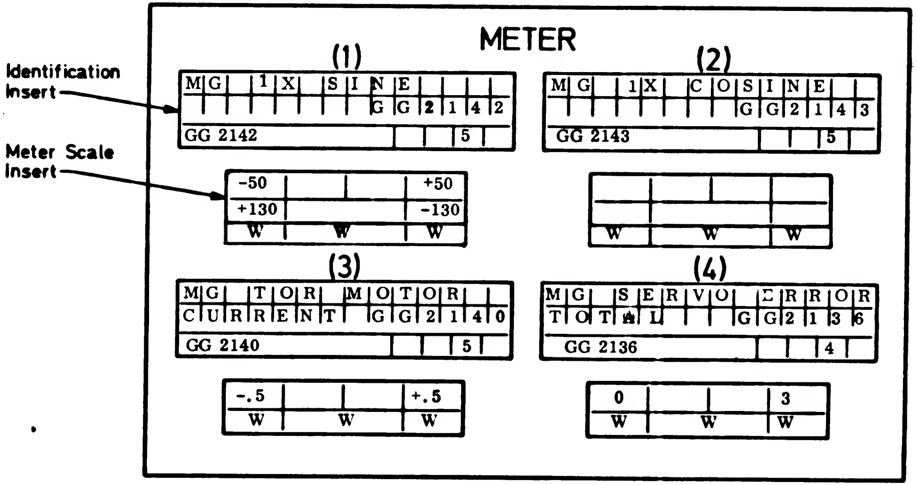
METER DISPLAY C

FIGURE 2C



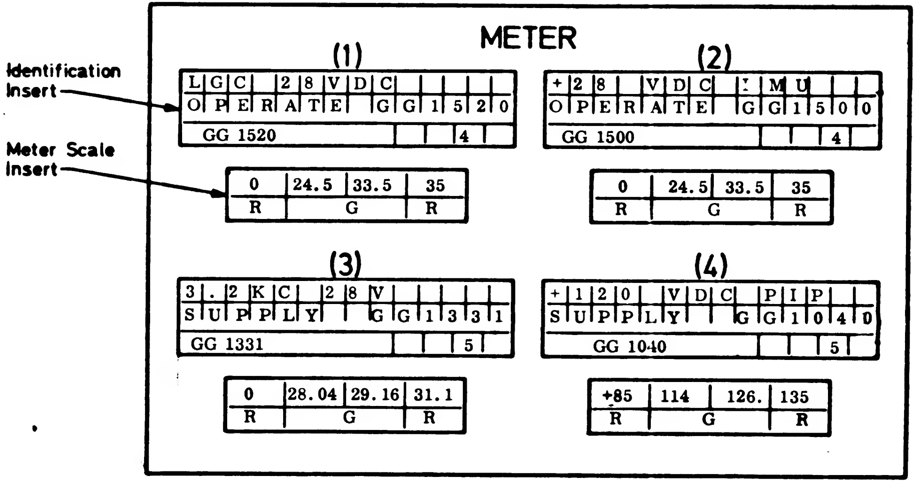
METER DISPLAY D

FIGURE 2D



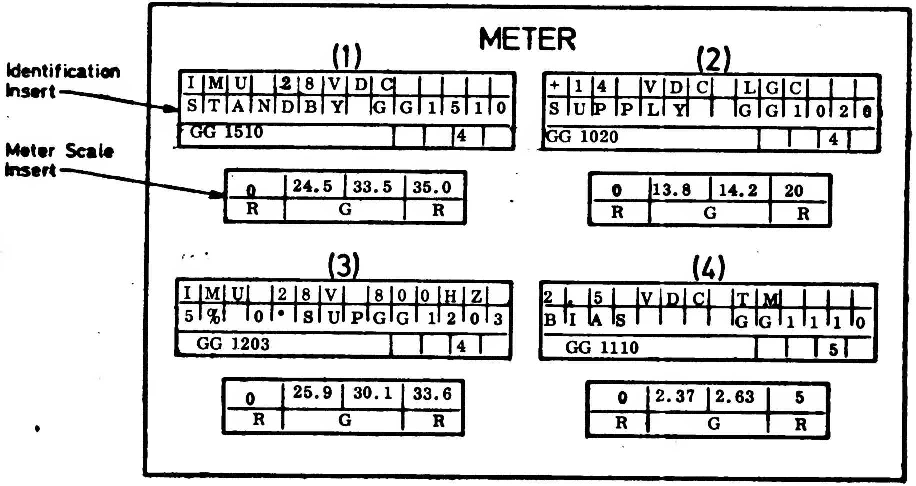
METER DISPLAY E

FIGURE 2E



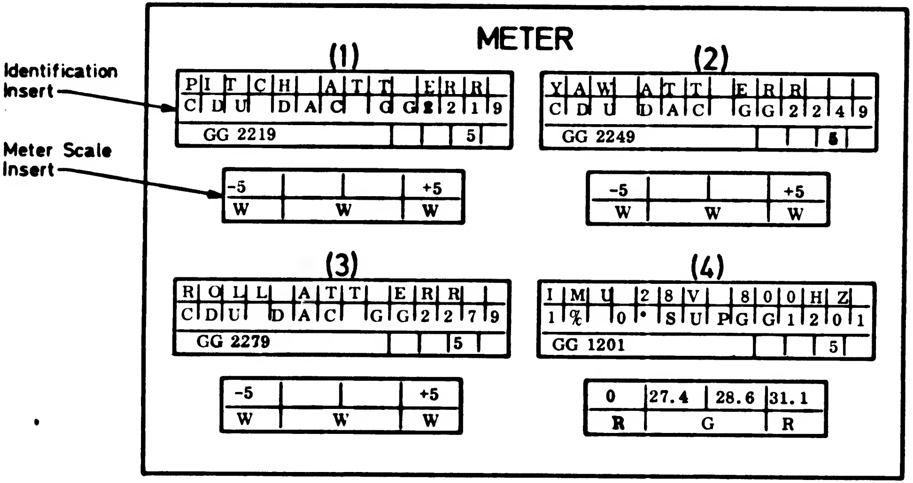
METER DISPLAY F

FIGURE 2F



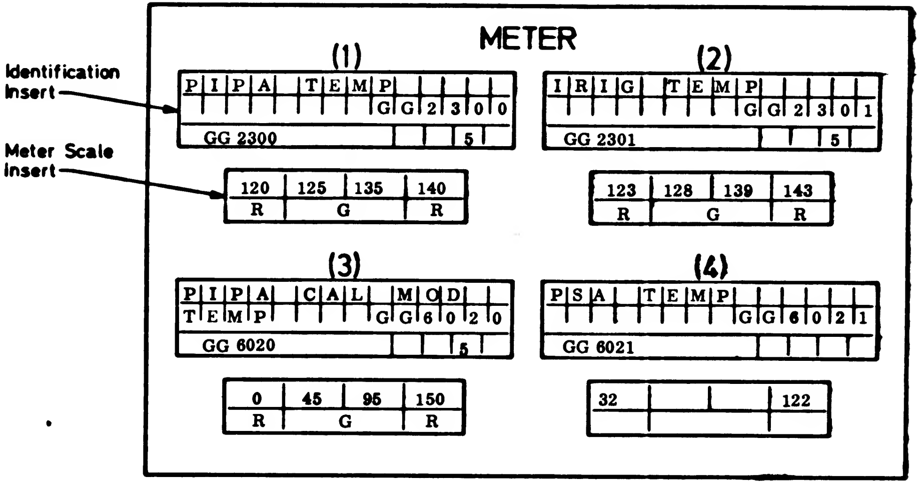
METER DISPLAY G

FIGURE 2G



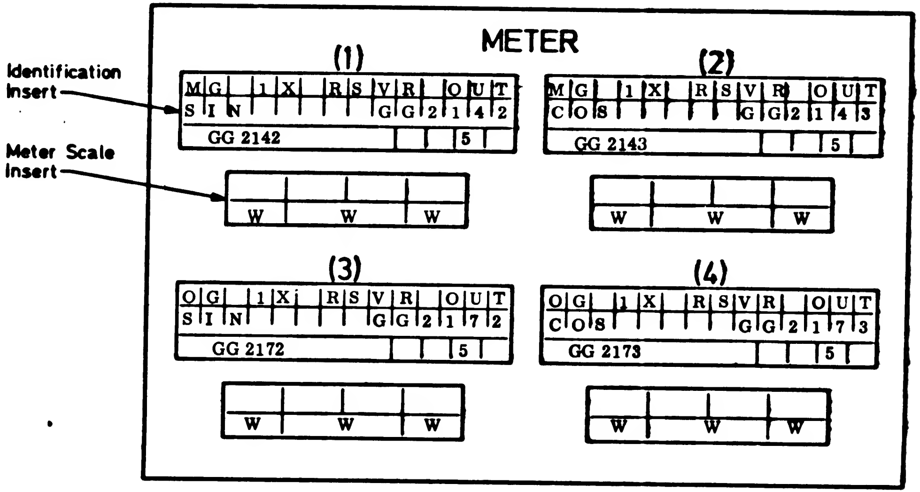
METER DISPLAY H

FIGURE 2H



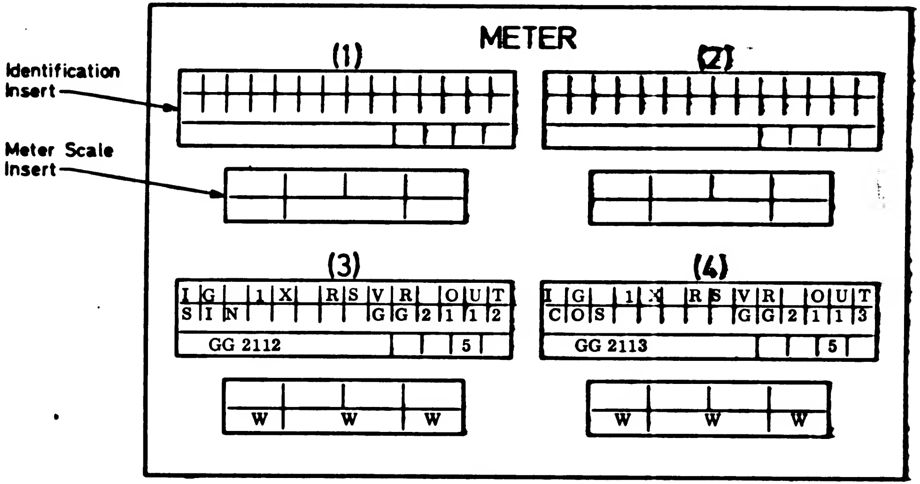
METER DISPLAY J

FIGURE 2J



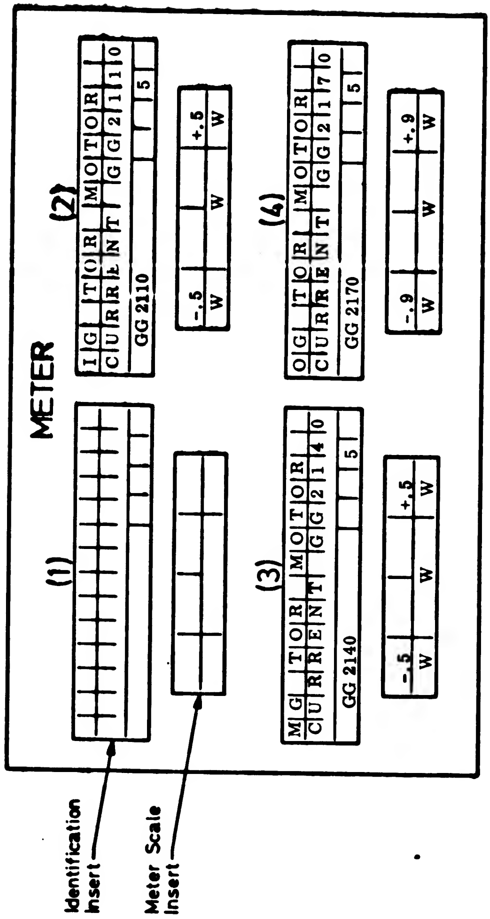
METER DISPLAY K

FIGURE 2K



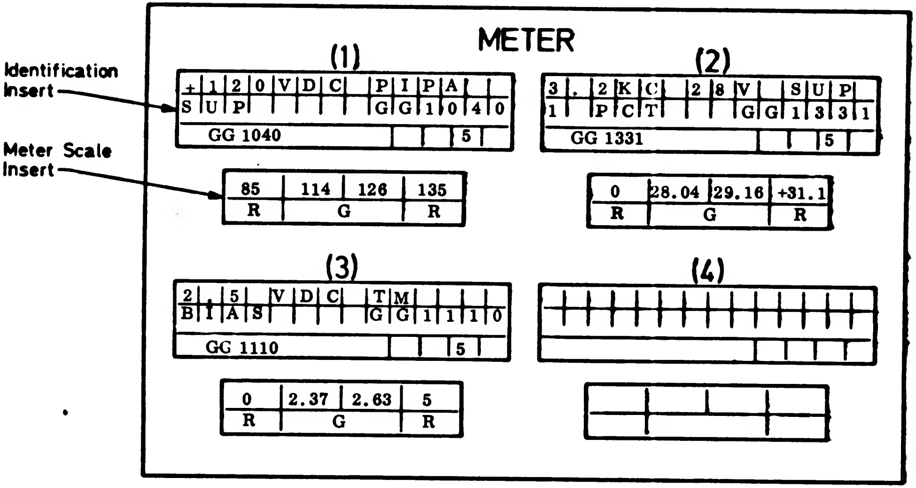
METER DISPLAY L

FIGURE 2L



METER DISPLAY M

FIGURE 2M



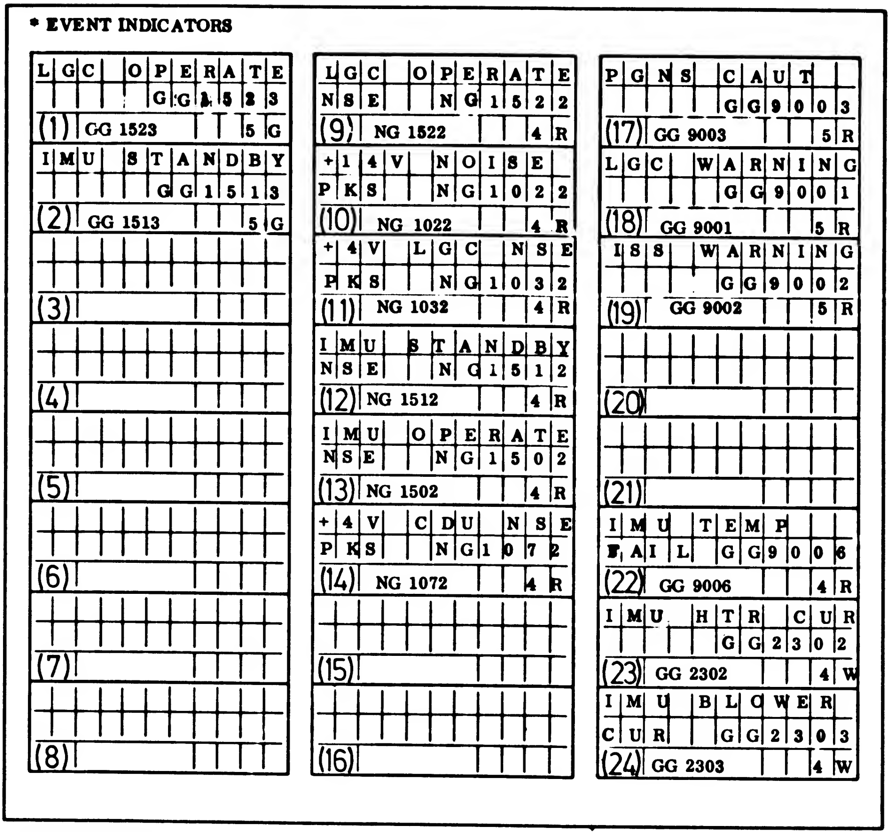
METER DISPLAY N

FIGURE 2N

3.6 EVENT INDICATOR DISPLAYS. The event indicator display format assignment for each LM shall be as specified in Table VI.

TABLE VI
EVENT INDICATOR
DISPLAYS

LM	CONSOLE/PANEL					
	004A3		014A1		004A4	
	Event	Module	Event	Module	Event	Module
	A4 Figure	A5 Figure	A1 Figure	A2 Figure		
1	3A	3B	3B	3A		
2	3A	3B	3B	3A		
3	3A	3B	3B	3A		
LTA8-M	3C			3C		



* See Figure 7B

EVENT INDICATOR DISPLAY A

FIGURE 3A

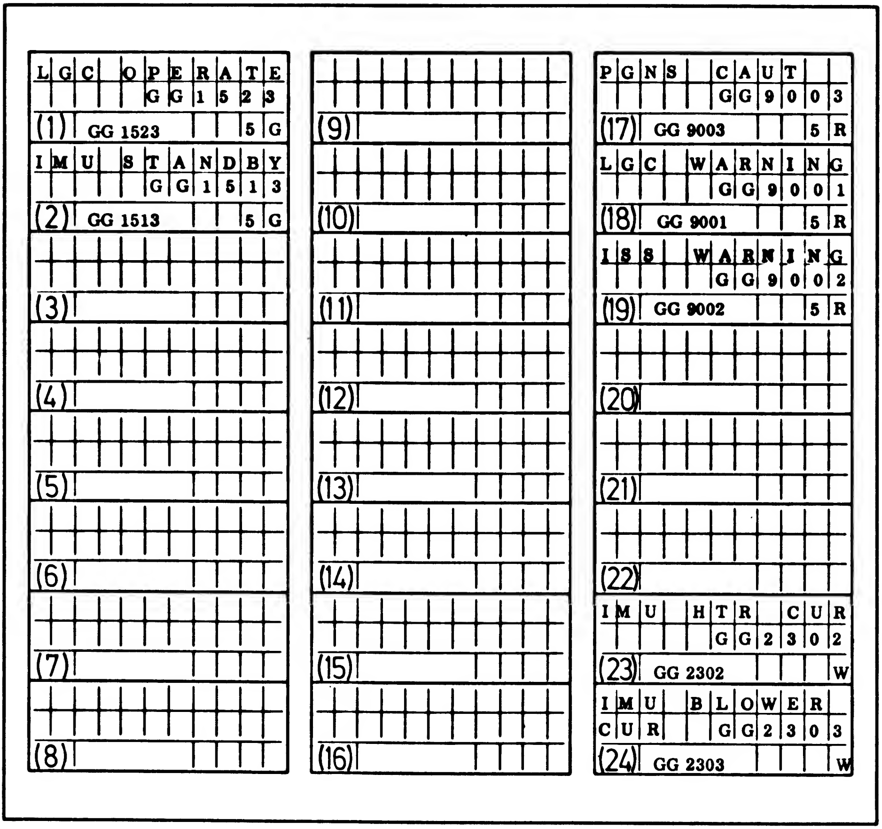
EVENT

No.	Legend	Measurement		
(1)	LR RG DATA NO GOOD	GN 7521*	5	W
(2)	LR VEL DATA NO GOOD	GN 7557*	5	W
(3)				
(4)	LR MODE CONTROL	GN 7584*	4	B
(5)	LR LGC ANT 1 POS CMD	GN 7533*	4	W
(6)	LR ANT POS NO 1	GN 7576*	4	Y
(7)	LR ANT POS NO 2	GN 7577*	4	Y
(8)				
(9)				
(10)				
(11)				
(12)				
(13)				
(14)				
(15)				
(16)				
(17)	RR AUTO ANG TRK ENABLE	GN 7615*	4	B
(18)	RR NO TRACK	GN 7621*	5	W
(19)	RR LO SCALE FACTOR	GN 7636*	4	B
(20)	RR PWR ON + MODE SW - LGC	GN 7637*	4	W
(21)				
(22)				
(23)				
(24)				

*These measurements are not controlled by this specification but are included for reference only

EVENT INDICATOR DISPLAY B

FIGURE 3B



EVENT INDICATOR DISPLAY C

FIGURE 3C

3.7 EVENT RECORDER SIGNAL ARRANGEMENT. The signals recorded on the 32 channel Event Recorder, Panel/Module Number 004A2A2 shall be arranged as specified in Table VII.

TABLE VII

EVENT RECORDER SIGNAL ARRANGEMENT

LM	SIGNAL ARRANGEMENT FIGURE
1	4A
2	4A
3	4A
LTA8-M	4B

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			TIMING
2	GG 1523	5	+28 VDC LGC OPER GG 1523
3	GG 1513	5	+28 VDC IMU STBY GG 1513
4	GL 0801 *		1024 TIMING PCM GL 0801
5	NG 1522	4	+28 VDC LGC NOISE PK NG 1522
6	NG 1022	4	+14 VDC LGC NOISE PK NG 1022
7	NG 1032	4	+4 VDC LGC NOISE PK NG 1032
8	NG 1512	4	+28 VDC IMU STBY NOISE NG 1512
9	NG 1502	4	+28 VDC IMU OP NOISE PK NG 1502
10	NG 1072	4	+4 VDC CDU NOISE PK NG 1072
11	GG 2302	4	IMU HEATER CUR GG 2302
12	GG 2303	4	IMU BLOWER CUR GG 2303
13	GG 9006	4	IMU TEMP OUT OF LIMITS GG 9006
14	GG 9001	5	LGC WARNING GG 9001
15	GG 9002	5	ISS WARNING GG 9002
16	GG 9003	5	PNGS CAUTION GG 9003
17	GL 4069 *	4	C+WE MASTER ALARM GL 4069
18			
19			
20			
21			
22	GN 7557 *	5	LR VEL DATA NO GOOD GN 7557
23	GN 7584 *	4	LR MODE CONTROL GN 7684
24	GN 7533 *	4	LR LGC ANT 1 POS CMD GN 7533
25	GN 7576 *	4	LR ANT POS NO. 1 GN 7576
26	GN 7577 *	4	LR ANT POS NO. 2 GN 7577
27	GN 7521 *	5	LR RANGE DATA NO GOOD GN 7521
28	GN 7615 *	4	RR AUTO ANG TRK EN GN 7615
29	GN 7621 *	5	RR NO TRACK GN 7621
30	GN 7636 *	4	RR LO SCALE FACTOR GN 7636
31	GN 7637 *	4	RR PWR ON MODE SW IN LGC GN 7637
32			TIMING
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

* These measurements are not controlled by this specification but are included for reference only.

EVENT RECORDER SIGNAL ARRANGEMENT

FIGURE 4A

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			TIMING
2	GG 1523	5	+28 VDC LGC OPER GG 1523
3	GG 1513	5	+28 VDC IMU STBY GG 1513
4			
5			
6			
7			
8			
9			
10			
11	GG 2302		IMU HEATER CUR GG 2302
12	GG 2303		IMU BLOWER CUR GG 2303
13			
14	GG 9001	5	LGC WARNING GG 9001
15	GG 9002	5	ISS WARNING GG 9002
16	GG 9003	5	PGNS CAUTION GG 9003
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			TIMING
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

EVENT RECORDER SIGNAL ARRANGEMENT

FIGURE 4B

3.8 ANALOG RECORDER SIGNAL ARRANGEMENT. The signals recorded on the Analog Recorder shall be arranged as specified in Table VIII.

TABLE VIII

ANALOG RECORDER SIGNAL ARRANGEMENT

LM	CONSOLE/PANEL		
	004A1		004A3
	Analog Module		Analog Module
	A2	A3	A2
1	Fig. 5A	Fig. 5B	Fig. 5C
2	Fig. 5A	Fig. 5B	Fig. 5C
3	Fig. 5A	Fig. 5B	Fig. 5C
LTA8-M	Fig. 5A	Fig. 5E	Fig. 5D

1	2	3
IG SERVO ERR IN PH GG 2107	IG TORQUE MTR CUR GG 2110	MG SERVO ERR IN PH GG 2137
Measurement No. GG 2107 Link No. 5	Measurement No. GG 2110 Link No. 5	Measurement No. GG 2137 Link No. 5

4	5	6
MG TORQUE MTR CUR GG 2140	OG SERVO ERR IN PH GG 2167	OG TORQUE MTR CUR GG 2170
Measurement No. GG 2140 Link No. 5	Measurement No. GG 2167 Link No. 5	Measurement No. GG 2170 Link No. 5

7	8
PIPA TEMP GG 2300	IRIG TEMP GG 2301
Measurement No. GG 2300 Link No. 5	Measurement No. GG 2301 Link No. 5

8 CHANNEL ANALOG RECORDER SIGNAL ARRANGEMENT A

FIGURE 5A

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 2220	4	IG CDU FINE ERROR GG 2220
1	2	GG 2001	5	X PIP SG OUT IN PH GG 2001
1	3	GG 1020	4	+ 14V LGC SUP GG1020
1	4	GG 3312	4	RR SHAFT CDU COARSE ER GG 3312
2	1	GG 2250	4	MG CDU FINE ERROR GG 2250
2	2	NG 1521	4	+28 VDC LGC OPR NOISE NG 1521
2	3	GG 1030	4	+4V LGC SUP GG 1030
2	4	GG 3322	4	RR TRUN CDU COARSE ER GG 3322
3	1	GG 2280	4	OG CDU FINE ERROR GG 2280
3	2	GG 2021	5	Y PIP SG OUT IN PH GG 2021
3	3	GG 1070	4	+4 VDC CDU PWR SUP GG 1070
3	4	GG 3311	4	RR SHAFT CDU FINE ER GG 3311
4	1	GG 2219	5	PITCH ATT ER DAC OUT GG 2219
4	2	NG 1501	4	+28 VDC IMU OPR NOISE NG 1501
4	3	GG 1201	5	IMU 28V 1% 800 CPS GG 1201
4	4	GG 3321	4	RR TRUN CDU FINE ER GG 3321
5	1	GG 2249	5	YAW ATT ER DAC OUT GG 2249
5	2	GG 2041	5	Z PIP SG OUT IN PH GG 2041
5	3	GG 1202	4	IMU .8 KC 5% -90 DEG GG 1202
5	4	GG 3324	5	RR TRUN IX RES OUT SIN GG 3324
6	1	GG 2279	5	ROLL ATT ER DAC OUT GG 2279
6	2	NG 1511	4	+28 VDC IMU STB NOISE NG 1511
6	3	GG 1203	4	IMU .8 KC 5% 0 DEG GG 1203
6	4	GG 3325	5	RR TRUN IX RES OUT COS GG 3325
7	1	GG 1331	5	3.2 KC 28V SUP 1% GG 1331
7	2	GG 1040	5	+120 VDC PIPA SUP GG1040
7	3	GG 1510	4	+28V IMU STBY GG 1510
7	4	GG 3304	5	RR SHAFT IX OUT SIN GG 3304
8	1	NG 1342*		HIGH RATE MEASUREMENTS
8	2	GG 1500	4	+28V IMU OPER GG 1500
8	3	GG 1520	4	+28V LGC OPER GG 1520
8	4	GG 3305	5	RR SHAFT IX OUT COS GG 3305
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

*NG 1342 is a dummy measurement number depicting a high rate assignment.

ANALOG RECORDER SIGNAL ARRANGEMENT B

FIGURE 5B

CHANNEL / SWITCH NO	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 2112	5	IG IX RSVR OUT SIN GG 2112
1	2	GG 2166	4	OG SERVO ERROR TOTAL GG 2166
1	3	NG 1501	4	+28V IMU OPER NOISE NG 1501
1	4	GN 7567 *	4	GAIN STATE 01 GN 7567
2	1	GG 2113	5	IG IX RSVR OUT COS GG 2113
2	2	GG 2281	4	OG CDU COARSE ERROR GG 2281
2	3	NG 1521	4	+28V LGC OPER NOISE NG 1521
2	4	GN 7568 *	4	GAIN STATE 02 GN 7568
3	1	GG 2142	5	MG IX RSVR OUT SIN GG 2142
3	2	GG 2106	4	IG SERVO ERROR TOTAL GG 2106
3	3	GG 2181	5	OG IX OUT SIN 11 DEG GG 2181
3	4	GN 7569 *	4	GAIN STATE 03 GN 7569
4	1	GG 2143	5	MG IX RSVR OUT COS GG 2143
4	2	GG 2221	4	IG CDU COARSE ERR GG 2221
4	3	GG 6020	5	PIP CAL MOD TEMP GG 6020
4	4	GN 7570 *	4	GAIN STATE 04 GN 7570
5	1	GG 2172	5	OG IX RSVR OUT SIN GG 2172
5	2	GG 2136	4	MG SERVO ERROR TOTAL GG 2136
5	3	GG 2121	5	IG IX OUT SIN 11 DEG GG 2121
5	4	GN 7647 *	4	ATM OUT SHAFT GN 7647
6	1	GG 2173	5	OG IX RSVR OUT COS GG 2173
6	2	GG 2251	4	MG CDU COARSE ERR GG 2251
6	3	GG 6021	4	PSA TEMP GG 6021
6	4	GN 7645 *	4	ATM OUT TRUN GN 7645
7	1	GG 1100	4	-28 VDC SUPPLY GG 1100
7	2	GN 7655 *	4	AC PWR 1 GN 7655
7	3	GG 2151	5	MG IX OUT SIN 11 DEG GG 2151
7	4	GN 7563 *	5	LR ANT TEMP GN 7563
8	1	GG 1110	5	2.5 VDC TM BIAS 1 GG 1110
8	2	GN 7656 *	4	AC PWR 2 GN 7656
8	3	GG 4300	4	LGC TEMP GG 4300
8	4	GN 7723 *	5	RR ANT TEMP GN 7723
CHANNEL / SWITCH NO	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

* These measurements are not controlled by this specification but are included for reference only.

ANALOG RECORDER SIGNAL ARRANGEMENT C

FIGURE 5C

CHANNEL / SWITCH NO	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 3324	5	RR TRUN 1X RES OUT SIN GG 3324
1	2	GG 2001	5	X PIP SG OUT IN PH GG 2001
1	3	GG 2112	5	IG 1X RSVR OUT SIN GG 2112
1	4	GG 4300		LGC TEMP GG 4300
2	1	GG 3325	5	RR TRUN 1X RES OUT COS GG 3325
2	2	GG 2021	5	Y PIP SG OUT IN PH GG 2021
2	3	GG 2113	5	IG 1X RSVR OUT COS GG 2113
2	4	GG 6021		PSA TEMP GG 6021
3	1			
3	2	GG 2041	5	Z PIP SG OUT IN PH GG 2041
3	3			
3	4	GG 8102		IMU PAD TEMP. AVE GG 8102
4	1	GG 2219	5	PITCH ATT ER DAC OUT GG 2219
4	2	GG 2181	5	OG 1X OUT SIN 11 DEG GG 2181
4	3	GG 1201	5	IMU 28V 1% 800 CPS GG 1201
4	4	GG 8103		IMU COOLANT INLET GG 8103
5	1	GG 2249	5	YAW ATT ER DAC OUT GG 2249
5	2	GG 2121	5	IG 1X OUT SIN 11 DEG GG 2121
5	3	GG 2142	5	MG 1X RSVR OUT SIN GG 2142
5	4	GG 8116	5	AOT EXT. VIEWING LENS GG 8116
6	1	GG 2279	5	ROLL ATT ER DAC OUT GG 2279
6	2	GG 2151	5	MG 1X OUT SIN 11 DEG GG 2151
6	3	GG 2143	5	MG 1X RSVR OUT COS GG 2143
6	4	GG 8117	5	AOT EXT PRESS SEAL GG 8117
7	1	GG 1331	5	3.2KC 28V SUP 1% GG 1331
7	2	GG 1040	5	+120 VDC PIPA SUP GG 1040
7	3	GG 2172	5	OG 1X RSVR OUT SIN GG 2172
7	4	GG 3304	5	RR SHAFT 1X OUT SIN GG 3304
8	1	GG 6020	5	PIP CAL MOD TEMP GG 6020
8	2	GG 1110	5	2.5 VDC TM BIAS 1 GG 1110
8	3	GG 2173	5	OG 1X RSVR OUT COS GG 2173
8	4	GG 3305	5	RR SHAFT 1X OUT COS GG 3305
CHANNEL / SWITCH NO	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

ANALOG RECORDER SIGNAL ARRANGEMENT D

FIGURE 5D

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 8104		PTA HDR (PIPA CAL MOD) GG 8104
1	2	GG 8108		LGC LOC 2 GG 8108
1	3	GG 8114		CDU TRAY X FRONT LEFT GG 8114
1	4			
2	1	GG 8107		LGC LOC 1 GG 8107
2	2	GG 8105		PTA HDR (PULSE TORQUE SUP) GG 8105
2	3			
2	4			
3	1	GG 8110		PSA HDR (800 C 5% PH -A SUP) GG 8110
3	2			
3	3			
3	4			
4	1	GG 8113		CDU TRAY X (4 VDC SUP) GG 8113
4	2	GG 8112		PSA HDR (GIMBAL SERVO AMP) GG 8112
4	3			
4	4			
5	1	GG 8106		PTA HDR (BINARY CUR. SW) GG 8106
5	2			
5	3			
5	4			
6	1	GG 8109		LGC LOC 3
6	2			
6	3			
6	4			
7	1	GG 8111		PSA HDR (800 C 5% PH-B SUP) GG 8111
7	2			
7	3			
7	4			
8	1	GG 8115		CDU TRAY X FRONT RIGHT GG 8115
8	2			
8	3			
8	4			
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

ANALOG RECORDER ARRANGEMENT E

FIGURE 5E

3.9 R-START SIGNAL ARRANGEMENT. The R-START signal arrangement for each LM shall be as specified in Table IX.

TABLE IX

R-START SIGNAL

ARRANGEMENT

LM	CONSOLE/PANEL	
	004A2	004A4
	Module A06	Module A05
1,2,3,LTA8-M	Figure 6B	Figure 6A

4A4A05

R-START 144				R-START 145			
			CRT ERROR RESET DG 0000	LGC DISPLAY PROGRAM DSKY G&N 622 DG 0001		LGC* DISPLAY RECORD G&N 624B	
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START 146				R-START 147 *			
K-START DUMP DG 0004	K-START VERIFY DG 0003	K-START LOAD- VERIFY DG 0002		PIPA REF SELECT DG 2501	X PIPA SELECT DG 2502	Y PIPA SELECT DG 2503	Z PIPA SELECT DG 2504
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

*Not applicable LTA8-M

R-START SIGNAL ARRANGEMENT

FIGURE 6A

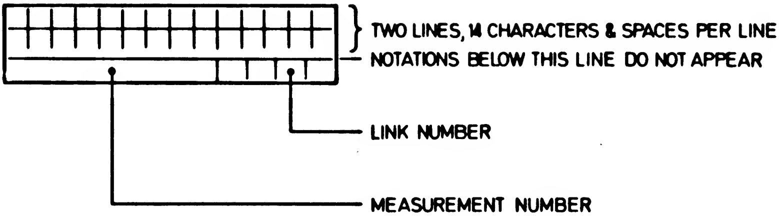
R-START 152				R-START 153			
	LGC TIME TRANS. G&N 603 DG 0007	LGC TIME CORR G&N 602 DG 0006	LGC CLOCK INITIAL G&N 601 DG 0005				
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START 154*				R-START 155*			
4 VDC SUPPLY LO WG 0023	4 VDC SUPPLY HI JG 0023	14 VDC SUPPLY LO WG 0022	14 VDC SUPPLY HI JG 0022	IG STEP INPUT JG 2505	MG STEP INPUT JG 2506	OG STEP INPUT JG 2507	LGC MARGIN TEST ENABLE JG 0021
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

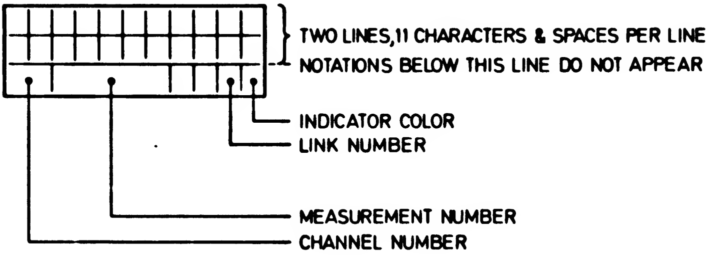
*Not applicable LTA8-M

R-START SIGNAL ARRANGEMENT B

FIGURE 6B


TWO LINES, 14 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
LINK NUMBER
MEASUREMENT NUMBER

7 A. - METER IDENTIFICATION INSERT


TWO LINES, 11 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
INDICATOR COLOR
LINK NUMBER
MEASUREMENT NUMBER
CHANNEL NUMBER

7 B. - EVENT INDICATOR DISPLAY FORMAT

FIGURE 7

3.10 C-START. - The C-START arrangement for each LM shall be as specified in Table X.

TABLE X

C-START

CODE NO.	STIMULUS NO.	CODE NO.	STIMULUS NO.	CODE NO.	STIMULUS NO.
1	DG 0009				
* 2	DG 9102				
* 3	ZG 0022				
* 4	ZG 0023				

CODE NO.	SUB-PROGRAM	C-START ENTRY
31	G&N 631	00000XXX
* 20	G&N 641	XX000000
	G&N 601 CODES 90, 91, 70, 80, 71	XXXXXXXX

*Not applicable to LTA8-M

4. QUALITY ASSURANCE PROVISIONS

4.1 INSPECTION. The requirements specified in Section 3 shall be verified by visual inspection.

5. PREPARATION FOR DELIVERY. - This section is not applicable to this specification.

6. NOTES.

6.1 VARIATIONS TO SIGNAL ARRANGEMENT. Signal arrangements within a display module or assembly may be varied, but the signals shall be retained by the original module or assembly specified. The signal arrangement for the CRT display (3.4) shall be restricted to variations within the half page specified.

6.2 SPACECRAFT LOCATION. The letter following the LM vehicle number indicates the location of the vehicle. Locations are as follows:

	Applicable at
-G	Grumman Aircraft
-F	KSC
-M	MSC
No letter	Applicable at all locations

6.3 NOMENCLATURE VARIANCE. Nomenclature may be varied by the user in Sections 3.5 thru 3.8, however, the measurement number must always be a portion of the nomenclature.

APOLLO G&N Specification
ND1002322 REV C
Original Issue Date:
Release Authority: TDRR 31355
Class A Release
CODE IDENT NO. 99974

G&N PROGRAMMING REQUIREMENTS
(DISPLAYS & CONTROLS)
FOR
ACCEPTANCE CHECKOUT EQUIPMENT
(LM)

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
				AC	NASA
10/27/66	A	31659	3-33. Was 33 pages, now	EA	WLS
			36 pages. RDG/AC		
11/15/66	B	31947	2-49 was 36 pages, now 49 pages RDG/AC	EA	- -
1/6/67	C	32583	3, 5-10, 12, 16-49, was 49 pages,	EA	--
			now 41 pages. RDG/AC		

This specification consists of page 1 to 41 inclusive.

APPROVALS	NASA/MSC				AC

3. REQUIREMENTS

3.1 G&N LM SUBPROGRAMS. The subprograms contained in Specification ND1002319 shall be used for the applicable LM configuration as specified in Table I.

TABLE I

SUBPROGRAMS

LM VEHICLE (Use Subprogram Indicated with "X")	AC ELECTRONICS G&N SUBPROGRAMS															
	601	602	603	621	621-200	622A	622-200	624A	624B	624-200	631	632	641	152A	671	681
LTA8-M				X		X		X			X	X			X	
LM1-G	X	X	X	X		X		X			X	X	X	X	X	X
LM1-K*	X	X	X		X		X			X	X	X	X	X	X	X
LM2-G	X	X	X	X		X		X			X	X	X	X	X	X
LM2-K	X	X	X	X		X			X		X	X	X	X	X	X
LM3-	X	X	X	X		X			X		X	X	X	X	X	X
LM4-G				X		X			X		X	X	X	X	X	X

*If flight ropes not available, use same subprograms as LM1-G.

3.2 SIGNAL BLINK LIMITS. The following signal blink limits shall apply to all G&N LM.

a. The following signals shall have blink limits equal to tolerances specified in the applicable LM Operational Checkout Procedure.

GG 1020
GG 1030
GG 1040
GG 1070
GG 1100
GG 1110
GG 1201
GG 1202
GG 1203
GG 1331
NG 1336
GG1500
GG 1510
GG 1520

3.4 CRT DISPLAYS. The CRT screen on the CRT module shall display information for each LM in accordance with Table III.

TABLE III

LM/CRT DISPLAY

LM	CRT DISPLAY FORMAT FIGURE
1-G	1A, 1B, 1C, 1D, 1E
1-K*	1K, 1L, 1M, 1N, 1P
2	1A, 1B, 1C, 1D, 1E
3	1A, 1B, 1C, 1D, 1E
4-G	1A, 1B, 1C, 1D, 1E
LTA8-M	1C, 1F, 1G, 1H, 1J

*If flight ropes not available, use same format as LM1-G

3.4.1 Measurement Numbers. Table IV correlates the signal measurement numbers to the scope spacing chart displays and indicates location of measurement within the display.

TABLE IV

CRT DISPLAY ASSIGNMENT MEASUREMENT LIST*

SIGNAL NUMBER	CRT FIG-LINE
GG 1020	1A-15, 1K-15
1030	1A-16, 1K-16
1040	1A-20, 1G-21, 1K-20
1070	1A-19, 1K-19
1100	1A-21, 1K-21
1110	1A-22, 1G-20, 1K-22
1201	1A-21, 1G-21, 1K-21
1202	1A-22, 1K-22
1203	1A-23, 1K-23
1331	1A-24, 1G-20, 1K-24
1500	1A-18, 1K-18
1510	1A-17, 1K-17
1520	1A-14, 1K-14
2001	1B-3, 1G-8, 1L-3
2021	1B-3, 1G-8, 1L-3
2041	1B-3, 1G-8, 1L-3
2106	1B-5, 1L-5
2107	1B-6, 1G-7, 1L-6
2110	1B-4, 1G-6, 1L-4
2112	1B-7, 1G-4, 1L-7
2113	1B-8, 1G-5, 1L-8
2112/2113 **	1B-15, 1L-15
2121	1B-17, 1G-3, 1L-17
2136	1B-5, 1L-5
2137	1B-6, 1G-7, 1L-6
2140	1B-4, 1G-6, 1L-4
2142	1B-7, 1G-4, 1L-7
2143	1B-8, 1G-5, 1L-8
2142/2143 **	1B-15, 1L-15
2151	1B-17, 1G-3, 1L-17
2166	1B-5, 1L-5
2167	1B-6, 1G-7, 1L-6
2170	1B-4, 1G-6, 1L-4
2172	1B-7, 1G-4, 1L-7
2173	1B-8, 1G-5, 1L-8
2172/2173 **	1B-15, 1L-15
2181	1B-17, 1G-3, 1L-17
GG 2219	1B-16, 1G-12, 1L-16
2220	1B-10, 1L-10
2221	1B-9, 1L-9
2249	1B-16, 1G-12, 1L-16
2250	1B-10, 1L-10
2251	1B-9, 1L-9
2279	1B-16, 1G-12, 1L-16
2280	1B-10, 1L-10
2281	1B-9, 1L-9
2300	1B-24, 1G-24, 1L-24
2301	1B-24, 1G-24, 1L-24
3304	1E-2
3305	1E-3
3304/3305 ***	1E-4
3311	1E-6
3312	1E-7
3321	1E-6
3322	1E-7
3324	1E-2,
3325	1E-3
3324/3325 ***	1E-4
4300	1E-21, 1G-22+
6020	1E-21, 1G-23
GG 6021	1E-21, 1G-23+
NG 1021	1A-15, 1K-15
1031	1A-16, 1K-16
1071	1A-19, 1K-19
1336	1A-24, 1K-24
1501	1A-18, 1K-18
1511	1A-17, 1K-17
NG 1521	1A-14, 1K-14

NOTE: * Whenever a choice between LINK 4 or LINK 5 exists, use LINK 5

** Processed by G&N 152A

*** Supplementary measurement, LTA8-M only.

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																							
1	0	1		L	R		A	L	T		D		O	K			X	X			R	R		O	N	/	A	U	T	O							X	X		
2	0	2		L	R	A	L	T		L	O	-	S	C			X	X			R	R		R	A	N	G	E		L	O	-	S	C			X	X		
3	0	3		L	R		V	E	L		D		O	K			X	X			R	R		D	A	T	A		G	O	O	D					X	X		
4	0	4		L	R		V	E	L		F	A	I	L			X	X			R	R		D	A	T	A		F	A	I	L					X	X		
5	0	5		L	R		P	O	S	2		C	M	D			X	X			R	R		L	O	C	K	O	N		A	B	L				X	X		
6	0	6		L	R		P	O	S		1						X	X			R	R		A	N	T		O	U	T							X	X		
7	0	7		L	R		P	O	S		2						X	X			R	R		A	N	T		M	O	D	E						X	X		
8	0	8		L	R		P	O	S		F	A	I	L			X	X			R	R		A	N	T		R	E	M	D						X	X		
9	0	9		F	O	R	V	E	L		X	X	X	.	X	X		F	P	S		L	A	T	V	E	L			X	X	X	.	X	X		F	P	S	
10	1	0		A	L	T		R	A	T	E				X	X	X	X	.	X		F	P	S																
11	1	1		H	O	R	I	Z		V	E	L					X	X			A	L	T		R	A	T	E		S	E	L					X	X		
12	1	2		R	R		E	R		C	T	R					X	X			A	L	T		M	E	T	E	R		A	C	T				X	X		
13		G	G				S	U	P	P	L	Y					V	D	C			N	G				N	O	I	S	E					V	R	M	S	
14	1	5	2	0		+	2	8		L	G	C				X	X	.	X		1	5	2	1		+	2	8		L	G	C				X	.	X	X	
15	1	0	2	0		+	1	4		L	G	C				X	X	.	X		1	0	2	1		+	1	4		L	G	C				X	.	X	X	
16	1	0	3	0		+		4		L	G	C				X	.	X	X		1	0	3	1		+		4		L	G	C				X	.	X	X	
17	1	5	1	0		+	2	8		S	B	Y				X	X	.	X		1	5	1	1		+	2	8		S	B	Y				X	.	X	X	
18	1	5	0	0		+	2	8		O	P	R				X	X	.	X		1	5	0	1		+	2	8		O	P	R				X	.	X	X	
19	1	0	7	0		+		4		C	D	U				X	.	X	X		1	0	7	1		+		4		C	D	U				X	.	X	X	
20	1	0	4	0		1	2	0		P	I	P					X	X	X			G	G				S	U	P	P	L	Y				V	R	M	S	
21	1	1	0	0		-	2	8		S	U	P			-	X	X	.	X		1	2	0	1		I	M	U		1	%	0				X	X	.	X	
22	1	1	1	0		T	M		B	I	A	S				X	.	X	X		1	2	0	2		I	M	U		5	%	0				X	X	.	X	
23		N	G			P	H		D	I	F						D	E	G		1	2	0	3		I	M	U		5	%	0				X	X	.	X	
24	1	3	3	6		3	.	2	/	L	G	C				X	X	X			1	3	3	1		2	8	V	3	.	2	H				X	X	.	X	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT A

FIGURE 1A

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																									
1	0	1			I	S	S		M	E	A	S					X	/	O	G					Y	/	I	G				Z	/	M	G						
2	0	2		P	I	P	A		C	T	R					X	X	X	X	X			X	X	X	X	X			X	X	X	X	X							
3	0	3		P	I	P	A		S	G		Ø						X	.	X	X				X	.	X	X				X	.	X	X						
4	0	4		T	O	R		M	O	T		C	U	R				.	X	X	X				.	X	X	X				.	X	X	X		A	M	P	S	
5	0	5		S	E	R	V	O		E	R		T	L				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S	
6	0	6		S	E	R	V	O		E	R		Ø					X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S	
7	0	7		1	X		R	S	V	R		S	I	N				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S	
8	0	8		1	X		R	S	V	R		C	O	S				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S	
9	0	9		C	D	U		C	R	S		E	R	R				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S	
10	1	0		C	D	U		F	I	N		E	R	R				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S	
11	1	1																																							
12	1	2																																							
13	1	3			I	S	S		M	E	A	S			X	/	Y	A	W			Y	/	P	I	T	C	H			Z	/	R	O	L	L					
14	1	4		C	D	U		A	N	G	L	E				X	X	X	.	X	X		X	X	X	.	X	X		X	X	X	.	X	X			D	E	G	
15	1	5		G	I	M	B		A	N	G	L	E					X	X	X					X	X	X					X	X	X				D	E	G	
16	1	6		D	A	C		A	T	T		E	R					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G	
17	1	7		I	X		S	I	N		1	1	•					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G	*
18	1	8		I	M	U		O	P	E	R						X	X			I	S	S		T	R	N	O	N		R	Q	S	T			X	X			
19	1	9		I	M	U		C	A	G	E						X	X			I	S	S		T	R	N	O	N		C	O	M	P			X	X			
20	2	0		C	D	U		C	O	N	T	R	O	L			X	X			I	N	I	T	I	A	L	I	Z	E		I	S	S			X	X			
21	2	1		C	O	R	S	E		A	L	I	G	N			X	X			D	S	P		I	N	R	T	L		D	A	T	A			X	X			
22	2	2		Z	E	R	O		I	C	D	U					X	X			I	S	S		E	R	R		C	T	R						X	X			
23	2	3		T	E	M	P		I	N		L	I	M			X	X			N	O		A	T	T	I	T	U	D	E						X	X			
24	2	4		P	I	P	A		T	E	M	P			X	X	X	.	X		•	F		I	R	I	G		T	E	M	P		X	X	X	.	X	•	F	*
25																																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	

* Not applicable LM4.

CRT DISPLAY

FORMAT B

FIGURE 1B

SCOPE SPACING CHART
FOR PAGE DISPLAY

AA																																									
1	0	1					A	C	T	I	V	I	T	Y							P	R	O	G	R	A	M				V	E	R	B		N	O	U	N		
2	0	2		U	P	L	I	N	K		C	O	M	P	U	T	E	R					X	X								X	X				X	X			
3	0	3		I	S	S		M	O	D	E		X	X	X	X	X	X											R	1			X	X	X	X	X				
4	0	4		I	N	H	I	B		U	P	L	I	N	K		X	X			K	S	E	Q		O	K		R	2			X	X	X	X	X				
5	0	5		B	L	O	C	K		U	P	L	I	N	K		X	X											R	3			X	X	X	X	X				
6	0	6		U	P	L	O	C	K								X	X			K	E	Y		R	E	L	E	A	S	E						X	X			
7	0	7		L	G	C		W	A	R	N	I	N	G			X	X			O	P	E	R	A	T	O	R		E	R	R					X	X			
8	0	8		G	I	M	B	A	L		L	O	C	K			X	X			P	R	O	G	R	A	M			A	L	M					X	X			
9	0	9		I	M	U					F	A	I	L			X	X			T	E	M	P		C	A	U	T	I	O	N					X	X			
10	1	0		P	I	P	A				F	A	I	L			X	X			R	E	D	O	C	T	R						X	X	X	X	X				
11	1	1		I	S	S	C	D	U		F	A	I	L			X	X			L	M	P	C	M	D							X	X	X	X	X				
12	1	2		R	R		C	D	U		F	A	I	L			X	X			F	A	I	L	R	E	G						X	X	X	X	X				
13	1	3		W	O	R	D		E	R	R		X	X	X	X	X	X	X		O	S	C		A	L	A	R	M								X	X			
14	1	4		S	Y	N	C		E	R	R						X	X			T	R	A	C	K	E	R		F	A	I	L					X	X			
15	1	5		R	E	L			E	R	R						X				T	E	S	T		A	L	A	R	M	S						X	X			
16	1	6		K	E	Y			E	R	R						X	X			A	B	L		L	G	C		S	T	B	Y					X	X			
17	1	7		P	A	R			E	R	R						X				P	I	P	A		M	E	A	S								X	X	X		**
18	1	8		V	E	R			E	R	R		X	X	X	X	X				H	I		R	A	T	E							G	G	X	X	X	X		**
19	1	9		U	P	L	N	K		F	A	S	T				X	X			I	G	N	I	C	D	U		F	A	I	L					X	X			
20	2	0		I	G	N	P	I	P		F	A	I	L			X	X			G	N		T	R		C	O	N	T	R	L				X	X	X	M	S	
21	2	1		I	G	N	I	M	U		F	A	I	L			X	X			T	I	M	E		E	R	R	O	R			X	X	X	X					
** 22	2	2		Δ	T	I	M	E		X	X	X	.	X	X	X	S	E	C		F	S				E	R	R	O	R			X								**
** 23	2	3		T	I	M	E		E	P				X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X	X		S	E	C		*
24	2	4		L	G	C		T	I	M	E			X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X			S	E	C		
25																																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	

* TIME EP = "TIME EPOCH" OR "TIME EPHEMERIS," WHICHEVER APPLICABLE.
** No FS error display required if ADAP routine for subprogram 681, N/A for LTA8-M

CRT DISPLAY

FORMAT C

FIGURE 1C

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1		+	Y	M	I										X	X			J	E	T	S		2	-	4		F	A	I	L				X	X		
2	0	2		-	Y	M	I										X	X			J	E	T	S		5	-	8		F	A	I	L				X	X		
3	0	3		+	E	L	L	P	D	/	+	P	M	I			X	X			J	E	T	S		1	-	3		F	A	I	L				X	X		
4	0	4		-	E	L	L	P	D	/	-	P	M	I			X	X			J	E	T	S		6	-	7		F	A	I	L				X	X		
5	0	5		+	A	Z	L	P	D	/	+	R	M	I			X	X			J	E	T	S		1	4	-	1	6		F	L				X	X		
6	0	6		-	A	Z	L	P	D	/	-	R	M	I			X	X			J	E	T	S		1	3	-	1	5		F	L				X	X		
7	0	7		+	X		T	R	A	N	S						X	X			J	E	T	S		9	-	1	2			F	L				X	X		
8	0	8		-	X		T	R	A	N	S						X	X			J	E	T	S		1	0	-	1	1		F	L				X	X		
9	0	9		+	Y		T	R	A	N	S						X	X			P	G	N	C	S		C	O	N	T		L	M				X	X		
10	1	0		-	Y		T	R	A	N	S						X	X			A	T	T	I	T	U	D	E		H	O	L	D				X	X		
11	1	1		+	Z		T	R	A	N	S						X	X			A	U	T	O		S	T	A	B								X	X		
12	1	2		-	Z		T	R	A	N	S						X	X			A	T	T		C	O	N	T		D	E	T					X	X		
13	1	3		E	N	G	I	N	E		O	N					X	X			G	I	M	B		O	F	F									X	X		
14	1	4		E	N	G	I	N	E		O	F	F				X	X			A	P	P		G	I	M	B		F	A	I	L				X	X		
15	1	5		+	P	I	T	C	H		T	R	I	M			X	X			E	N	G	I	N	E		A	R	M	E	D					X	X		
16	1	6		-	P	I	T	C	H		T	R	I	M			X	X			S	T	A	G	E		V	E	R	I	F						X	X		
17	1	7		+	R	O	L	L			T	R	I	M			X	X			A	B	O	R	T		S	T	A	G	E						X	X		
18	1	8		-	R	O	L	L			T	R	I	M			X	X			A	B	O	R	T												X	X		
19	1	9		A	U	T	O		T	H	R	O	T				X	X			T	H	R	U	S	T		D	R	V							X	X		
20	2	0																																						
21	2	1			L	R		A	L	T		F	T										X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
22	2	2			L	R		V	X			F	P	S									X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
23	2	3			L	R		V	Y			F	P	S									X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
24	2	4			L	R		V	Z			F	P	S										X	X	X	X	X	X	X	X	.	X	X	X	X	X			
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT D

FIGURE 1D

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1		R	R		S	H	A	F	T														R	R		T	R	U	N	N	I	O	N							
2	0	2		C	D	U		/		D	E	G		X	X	X	.	X	X		C	D	U		/		D	E	G			X	X	.	X	X	X			
3	0	3																																						
4	0	4		L	R		A	L	T		F	T											X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
5	0	5		L	R		V	X			F	P	S										X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
6	0	6		L	R		V	Y			F	P	S										X	X	X	X	X	X	X	X	X	.	X	X	X	X	X			
7	0	7		L	R		V	Z			F	P	S											X	X	X	X	X	X	X	X	.	X	X	X	X	X			
8	0	8		A	L	T	S	A	V	E			D	P											X	X	X	X	X	X	X	.	X	X	X		F	E	E	T
9	0	9		F	I	N	A	L	T				D	P											X	X	X	X	X	X	X	.	X	X	X		F	E	E	T
10	1	0		R	R		R	A	N	G	E											X	X	X	X	X	X	X	X	X	X	.	X	X	X		F	E	E	T
11	1	1		R	R		R	A	N	G	E		R	A	T	E						X	X	X	X	X	X	X	X	X	X	.	X	X	X		F	P	S	
12	1	2		C	O	N	T		D	E	S	I	G				O	X	X		Z	E	R	O		R	R		C	D	U						O	X	X	
13	1	3		L	R		A	L	T		D		O	K			O	X	X		R	R		O	N	/	A	U	T	O							O	X	X	
14	1	4		L	R	A	L	T		L	O	-	S	C			O	X	X		R	R		R	A	N	G	E		L	O	-	S	L			O	X	X	
15	1	5		L	R		V	E	L		D		O	K			O	X	X		R	R		D	A	T	A		G	O	O	D					O	X	X	
16	1	6		L	R		V	E	L		F	A	I	L			O	X	X		R	R		D	A	T	A		F	A	I	L					O	X	X	
17	1	7		L	R		P	O	S	2		C	M	D			O	X	X		R	R		L	O	C	K	O	N		A	B	L				O	X	X	
18	1	8		L	R		P	O	S		1						O	X	X		R	R		A	N	T		O	U	T							O	X	X	
19	1	9		L	R		P	O	S		2						O	X	X		R	R		A	N	T		M	O	D	E						O	X	X	
20	2	0		L	R		P	O	S		F	A	I	L			O	X	X		R	R		A	N	T		R	E	M	D						O	X	X	
21	2	1		F	O	R	V	E	L		X	X	X	.	X	X		F	P	S		L	A	T	V	E	L			X	X	X	.	X	X		F	P	S	
22	2	2		A	L	T		R	A	T	E				X	X	X	X	.	X		F	P	S																
23	2	3		H	O	R	I	Z		V	E	L					O	X	X		A	L	T		R	A	T	E		S	E	L					O	X	X	
24	2	4		R	R		E	R		C	T	R					O	X	X		A	L	T		M	E	T	E	R		A	C	T				O	X	X	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT F

FIGURE 1F

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1		L	R		A	L	T		D		O	K				X	X		R	R		O	N	/	A	U	T	O								X	X	
2	0	2		L	R	A	L	T		L	O	-	S	C				X	X		R	R		R	A	N	G	E		L	O	-	S	C				X	X	
3	0	3		L	R		V	E	L		D		O	K				X	X		R	R		D	A	T	A		G	O	O	D						X	X	
4	0	4																			Z	E	R	O		R	R		C	D	U							X	X	
5	0	5		L	R		P	O	S	2		C	M	D				X	X		R	R		L	O	C	K	O	N		A	B	L	E				X	X	
6	0	6		L	R		P	O	S		1							X	X																					
7	0	7		L	R		P	O	S		2							X	X																					
8	0	8																																						
9	0	9																																						
10	1	0																																						
11	1	1		H	O	R	I	Z		V	E	L						X	X			A	L	T		R	A	T	E		S	E	L					X	X	
12	1	2		R	R		E	R		C	T	R						X	X			A	L	T		M	E	T	E	R		A	C	T				X	X	
13		G	G				S	U	P	P	L	Y					V	D	C			N	G				N	O	I	S	E					V	R	M	S	
14	1	5	2	0		+	2	8		L	G	C				X	X	.	X		1	5	2	1		+	2	8		L	G	C				X	.	X	X	
15	1	0	2	0		+	1	4		L	G	C				X	X	.	X		1	0	2	1		+	1	4		L	G	C				X	.	X	X	
16	1	0	3	0		+		4		L	G	C				X	.	X	X		1	0	3	1		+		4		L	G	C				X	.	X	X	
17	1	5	1	0		+	2	8		S	B	Y				X	X	.	X		1	5	1	1		+	2	8		S	B	Y				X	.	X	X	
18	1	5	0	0		+	2	8		O	P	R				X	X	.	X		1	5	0	1		+	2	8		O	P	R				X	.	X	X	
19	1	0	7	0		+		4		C	D	U				X	.	X	X		1	0	7	1		+		4		C	D	U				X	.	X	X	
20	1	0	4	0		1	2	0		P	I	P					X	X	X			G	G				S	U	P	P	L	Y				V	R	M	S	
21	1	1	0	0		-	2	8		S	U	P			-	X	X	.	X		1	2	0	1		I	M	U		1	%	0				X	X	.	X	
22	1	1	1	0		T	M		B	I	A	S				X	.	X	X		1	2	0	2		I	M	U		5	%	W				X	X	.	X	
23		N	G				P	H		D	I	F					D	E	G		1	2	0	3		I	M	U		5	%	0				X	X	.	X	
24	1	3	3	6		3	.	2	/	L	G	C				X	X	X			1	3	3	1		2	8	V	3	.	2	H				X	X	.	X	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT 1K
FIGURE 1K

SCOPE SPACING CHART
FOR PAGE DISPLAY

AA																																								
1	0	1			I	S	S		M	E	A	S					X	/	O	G					Y	/	I	G				Z	/	M	G					
2	0	2		P	I	P	A		C	T	R					X	X	X	X	X			X	X	X	X	X			X	X	X	X	X						
3	0	3		P	I	P	A		S	G		φ						X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
4	0	4		T	O	R		M	O	T		C	U	R				.	X	X	X				.	X	X	X				.	X	X	X		A	M	P	S
5	0	5		S	E	R	V	O		E	R		T	L				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
6	0	6		S	E	R	V	O		E	R		φ					X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
7	0	7		1	X		R	S	V	R		S	I	N				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S
8	0	8		1	X		R	S	V	R		C	O	S				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S
9	0	9		C	D	U		C	R	S		E	R	R				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
10	1	0		C	D	U		F	I	N		E	R	R				X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
11	1	1		C	O	M	P	T	O	R	K					X	X	X	X	X			X	X	X	X	X			X	X	X	X	X			G	P	L	S
12	1	2		L	G	C		P	T	A		P	S	A					X	X	X					X	X	X					X	X	X		D	E	G	F
13	1	3			I	S	S		M	E	A	S			X	/	Y	A	W			Y	/	P	I	T	C	H			Z	/	R	O	L	L				
14	1	4		C	D	U		A	N	G	L	E				X	X	X	.	X	X		X	X	X	.	X	X		X	X	X	.	X	X			D	E	G
15	1	5		G	I	M	B		A	N	G	L	E					X	X	X					X	X	X					X	X	X				D	E	G
16	1	6		D	A	C		A	T	T		E	R					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G
17	1	7		1	X		S	I	N		1	1	°					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G
18	1	8		I	M	U		O	P	E	R							X	X		I	S	S		T	R	N	O	N		R	Q	S	T				X	X	
19	1	9		I	M	U		C	A	G	E							X	X		I	S	S		T	R	N	O	N		C	O	M	P				X	X	
20	2	0		C	D	U		C	O	N	T	R	O	L				X	X		I	N	I	T	I	A	L	I	Z	E		I	S	S				X	X	
21	2	1		C	O	R	S	E		A	L	I	G	N				X	X		D	S	P		I	N	R	T	L		D	A	T	A				X	X	
22	2	2		Z	E	R	O		I	C	D	U						X	X		I	S	S		E	R	R		C	T	R							X	X	
23	2	3		T	E	M	P		I	N		L	I	M				X	X		N	O		A	T	T	I	T	U	D	E							X	X	
24	2	4		P	I	P	A		T	E	M	P			X	X	X	°	X		•	F		I	R	I	G		T	E	M	P		X	X	X	.	X	°	F
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT 1L
FIGURE 1L

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1					A	C	T	I	V	I	T	Y							P	R	O	G	R	A	M				V	E	R	B		N	O	U	N	
2	0	2		U	P	L	I	N	K		C	O	M	P	U	T	E	R					X	X								X	X				X	X		
3	0	3		I	S	S		M	O	D	E		X	X	X	X	X	X											R	1			X	X	X	X	X			
4	0	4		I	N	H	I	B		U	P	L	I	N	K			X	X		K	S	E	Q		O	K		R	2			X	X	X	X	X			
5	0	5		B	L	O	C	K		U	P	L	I	N	K			X	X										R	3			X	X	X	X	X			
6	0	6		U	P	L	O	C	K									X	X		K	E	Y		R	E	L	E	A	S	E							X	X	
7	0	7		L	G	C		W	A	R	N	I	N	G				X	X		O	P	E	R	A	T	O	R		E	R	R						X	X	
8	0	8		G	I	M	B	A	L		L	O	C	K				X	X		P	R	O	G	R	A	M			A	L	M						X	X	
9	0	9		I	M	U					F	A	I	L				X	X		T	E	M	P		C	A	U	T	I	O	N						X	X	
10	1	0		P	I	P	A				F	A	I	L				X	X		R	E	D	O	C	T	R						X	X	X	X	X			
11	1	1		I	S	S	C	D	U		F	A	I	L				X	X		G	R	R		F	L	A	G										X	X	
12	1	2		R	R		C	D	U		F	A	I	L				X	X																					
13	1	3		W	O	R	D		E	R	R							X	X		O	S	C		A	L	A	R	M									X	X	
14	1	4		S	Y	N	C		E	R	R							X	X		T	R	A	C	K	E	R		F	A	I	L						X	X	
15	1	5		R	E	L			E	R	R							X			T	E	S	T		A	L	A	R	M	S							X	X	
16	1	6		K	E	Y			E	R	R							X	X		A	B	L		L	G	C		S	T	B	Y						X	X	
17	1	7		P	A	R			E	R	R							X			P	I	P	A		M	E	A	S								X	X	X	
18	1	8		V	E	R			E	R	R			X	X	X	X	X			H	I		R	A	T	E							G	G	X	X	X	X	
19	1	9		U	P	L	N	K		F	A	S	T					X	X		I	G	N	I	C	D	U		F	A	I	L						X	X	
20	2	0		I	G	N	P	I	P		F	A	I	L				X	X		G	N		T	R		C	O	N	T	R	L				X	X	X	M	S
21	2	1		I	G	N	I	M	U		F	A	I	L				X	X		T	I	M	E		E	R	R	O	R			X	X	X	X				
22	2	2		Δ	T	I	M	E		X	X	X	.	X	X	X	S	E	C		F	S				E	R	R	O	R			X							
23	2	3		T	I	M	E		E	P				X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X	X		S	E	C	
24	2	4		L	G	C		T	I	M	E			X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X			S	E	C	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT 1M
FIGURE 1M

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1		+	Y	M	I											X	X		J	E	T	S		2	-	4		F	A	I	L					X	X	
2	0	2		-	Y	M	I											X	X		J	E	T	S		5	-	8		F	A	I	L					X	X	
3	0	3		+	E	L	L	P	D	/	+	P	M	I				X	X		J	E	T	S		1	-	3		F	A	I	L					X	X	
4	0	4		-	E	L	L	P	D	/	-	P	M	I				X	X		J	E	T	S		6	-	7		F	A	I	L					X	X	
5	0	5		+	A	Z	L	P	D	/	+	R	M	I				X	X		J	E	T	S		1	4	-	1	6		F	L					X	X	
6	0	6		-	A	Z	L	P	D	/	-	R	M	I				X	X		J	E	T	S		1	3	-	1	5		F	L					X	X	
7	0	7		+	X		T	R	A	N	S							X	X		J	E	T	S		9	-	1	2			F	L					X	X	
8	0	8		-	X		T	R	A	N	S							X	X		J	E	T	S		1	0	-	1	1		F	L					X	X	
9	0	9		+	Y		T	R	A	N	S							X	X		P	G	N	C	S		C	O	N	T		L	M					X	X	
10	1	0		-	Y		T	R	A	N	S							X	X		A	T	T	I	T	U	D	E		H	O	L	D					X	X	
11	1	1		+	Z		T	R	A	N	S							X	X		A	U	T	O		S	T	A	B									X	X	
12	1	2		-	Z		T	R	A	N	S							X	X		A	T	T		C	O	N	T		D	E	T						X	X	
13	1	3		E	N	G	I	N	E		O	N						X	X		G	I	M	B		O	F	F										X	X	
14	1	4		E	N	G	I	N	E		O	F	F					X	X		A	P	P		G	I	M	B		F	A	I	L					X	X	
15	1	5		+	P	I	T	C	H		T	R	I	M				X	X		E	N	G	I	N	E		A	R	M	E	D						X	X	
16	1	6		-	P	I	T	C	H		T	R	I	M				X	X		S	T	A	G	E		V	E	R	I	F							X	X	
17	1	7		+	R	O	L	L			T	R	I	M				X	X		A	B	O	R	T		S	T	A	G	E							X	X	
18	1	8		-	R	O	L	L			T	R	I	M				X	X		A	B	O	R	T													X	X	
19	1	9		A	U	T	O		T	H	R	O	T					X	X		T	H	R	U	S	T		D	R	V								X	X	
20	2	0		L	M	P				X	X	X		X	X	X		X	X	X		X	X	X		X	X	X		X	X	X		X	X	X		X	X	X
21	2	1		L	M	P	I	N			X										L	M	P	O	U	T			X											
22	2	2		R		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X
23	2	3		V		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X
24	2	4		T		X	X	X	X	X		X	X	X	X	X																								
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY
FORMAT 1N
FIGURE 1N

SCOPE SPACING CHART FOR PAGE DISPLAY

AA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	0	1		M	P	H	A	S	E					X	X						X	X						X	X						X	X				
2	0	2		M	P	T	I	M	E		X	X	X	X	X			X	X	X	X	X			X	X	X	X	X			X	X	X	X	X		S	E	C
3	0	3		P	H	A	S	E		N	U	M						X	X																					
4	0	4		T	E	V	E	N	T					X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X			S	E	C	
5	0	5		T	I	G	N							X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X			S	E	C	
6	0	6		T	T	G	O							X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X			S	E	C	
7	0	7		T	I	M	E	R	S		E	N	B	L				X	X		R	C	S		S	O	A	K		I	N	H						X	X	
8	0	8		D	A	P		E	N	A	B	L	E	D				X	X		D	P	S		S	O	A	K		I	N	H						X	X	
9	0	9		F	A		I	N	H	I	B	I	T					X	X		R	C	S		T	E	S	T		I	N	H						X	X	
10	1	0		T	U	M	B	F	L	A	G							X	X		S	T	A	R	T		U	P	D	A	T	E						X	X	
11	1	1		T	U	M	B	M	D	N								X	X		U	P	D	A	T		F	L	A	G								X	X	
12	1	2		A	V	E		G										X	X		O	R	B		I	N	T	E	G									X	X	
13	1	3		M	A	X		D	B		S	L	C	T				X	X		A	S	C		F	D		T	E	S	T							X	X	
14	1	4		R	A	T	E		H	O	L	D						X	X		A	B	O	R	T		E	N	B	L								X	X	
15	1	5		G	I	M		C	T	L		I	M	P				X	X		A	B	O	R	T		C	M	D		R	/	P					X	X	
16	1	6		P	F	O	R	C	E		C	P	L	S				X	X		K	A	L	C	M	A	N	U										X	X	
17	1	7		U	L	L	A	G	E	R								X	X		I	G	N		F	N	L		Y	A	W							X	X	
18	1	8		A	P	S		B	U	R	N							X	X		N	O		F	N	L		Y	A	W		R	Q	D				X	X	
19	1	9		I	G	N		D	E	L	A	Y						X	X		S	/	C		N	O	N	X	L		F	L	T					X	X	
20	2	0		L	A	M	B		T	R	G	T						X	X		E	X	T		T	R	G	T		S	E	T	U	P				X	X	
21	2	1		T	G	O		E	S	T								X	X		T	R	F		A	N	G		G	T		1	8	0				X	X	
22	2	2		G	U	E	S	S		A	V	A	I	L				X	X		L	A	M	B		R	T	N		N	C	O	N					X	X	
23	2	3		1	S	T		L	A	M	B		I					X	X		R	C	O		N	O	T		C	N	T	R	L	O				X	X	
24	2	4		L	A	M	B		C	O	M	P						X	X																					
25																																								

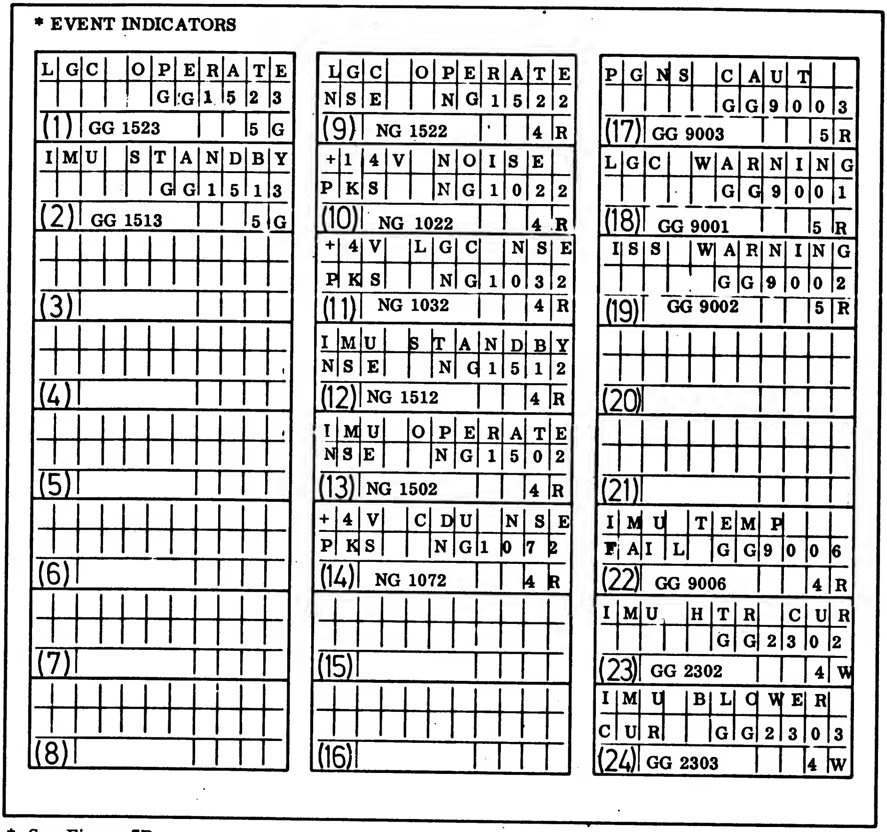
CRT DISPLAY
FORMAT 1P
FIGURE 1P

3.5 METER DISPLAYS. The use of meter modules 004A2A3, 004A2A4, 004A3A6, 004A3A7, 004A3A8, 004A3A9, 014A1A3, and 014A1A4 shall be determined by the testing activity.

3.6 EVENT INDICATOR DISPLAYS. The event indicator display format assignment for each LM shall be as specified in Table V.

TABLE V
EVENT INDICATOR
DISPLAYS

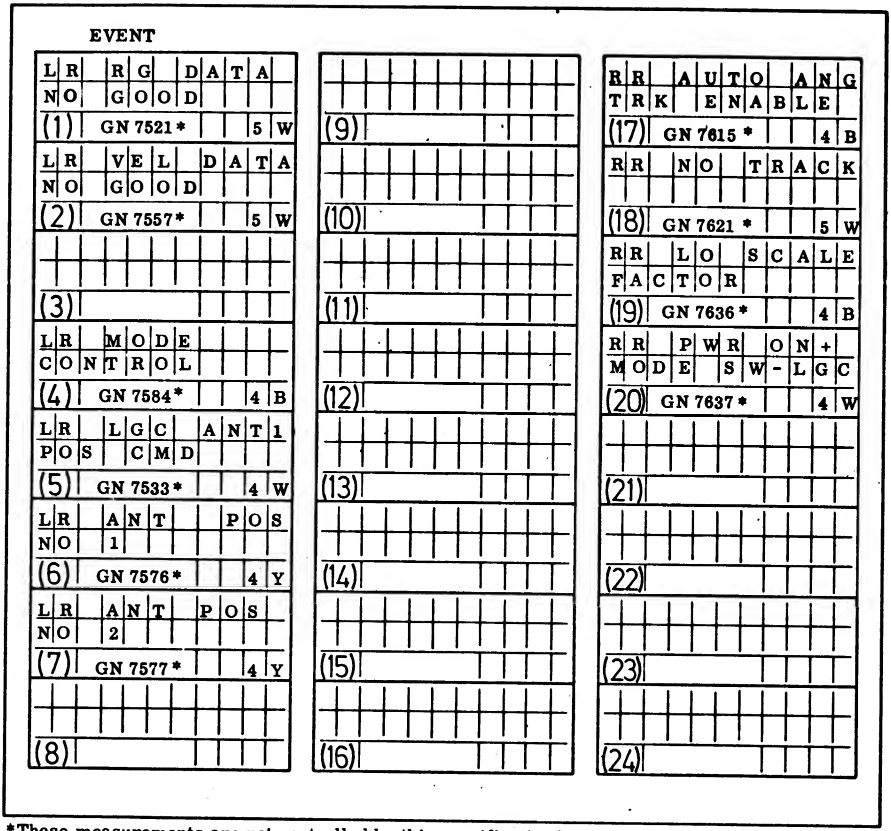
LM	CONSOLE/PANEL					
	004A3		014A1		004A4	
	Event	Module	Event	Module	Event	Module
	A4 Figure	A5 Figure	A1 Figure	A2 Figure		
1	3A	3B	3B	3A		
2	3A	3B	3B	3A		
3	3A	3B	3B	3A		
4	3A	3B	3B	3A		
LTA8-M	3C			3C		



* See Figure 7B

EVENT INDICATOR DISPLAY A

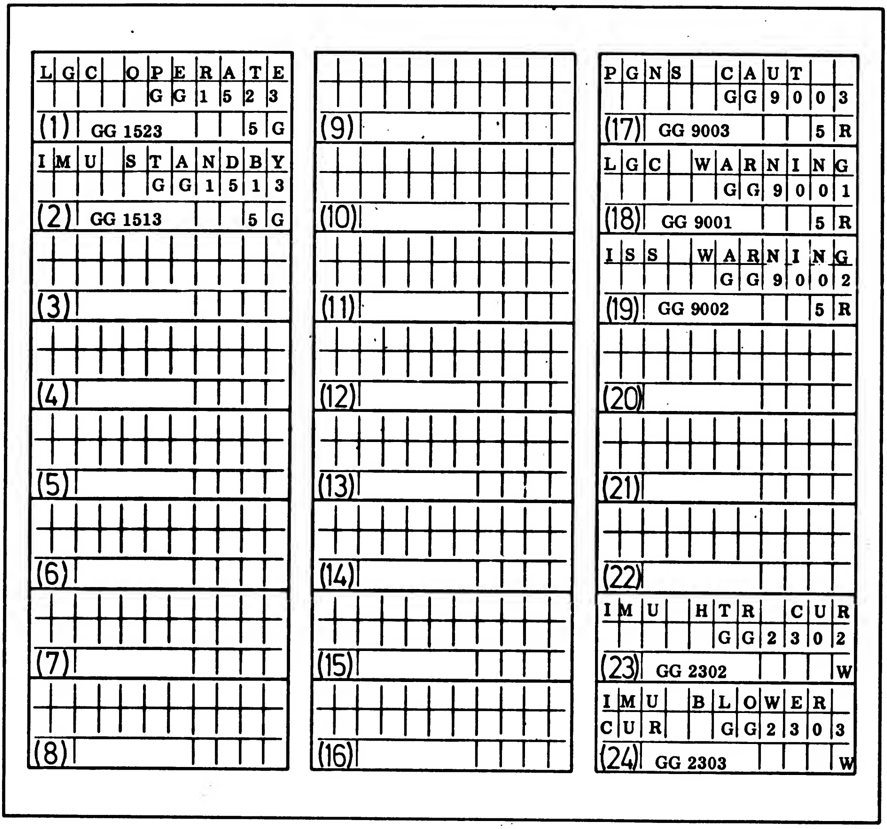
FIGURE 3A



*These measurements are not controlled by this specification but are included for reference only

EVENT INDICATOR DISPLAY B

FIGURE 3B



EVENT INDICATOR DISPLAY C

FIGURE 3C

3.7 EVENT RECORDER SIGNAL ARRANGEMENT. The signals recorded on the 32 channel Event Recorder, Panel/Module Number 004A2A2 shall be arranged as specified in Table VI.

TABLE VI.

EVENT RECORDER SIGNAL ARRANGEMENT

LM	SIGNAL ARRANGEMENT FIGURE
1	4A
2	4A
3	4A
4	4A
LTA8-M	4B

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			TIMING
2	GG 1523	5	+28 VDC LGC OPER GG 1523
3	GG 1513	5	+28 VDC IMU STBY GG 1513
4	GL 0801 *		1024 TIMING PCM GL 0801
5	NG 1522	4	+28 VDC LGC NOISE PK NG 1522
6	NG 1022	4	+14 VDC LGC NOISE PK NG 1022
7	NG 1032	4	+4 VDC LGC NOISE PK NG 1032
8	NG 1512	4	+28 VDC IMU STBY NOISE NG 1512
9	NG 1502	4	+28 VDC IMU OP NOISE PK NG 1502
10	NG 1072	4	+4 VDC CDU NOISE PK NG 1072
11	GG 2302	4	IMU HEATER CUR GG 2302
12	GG 2303	4	IMU BLOWER CUR GG 2303
13	GG 9006	4	IMU TEMP OUT OF LIMITS GG 9006
14	GG 9001	5	LGC WARNING GG 9001
15	GG 9002	5	ISS WARNING GG 9002
16	GG 9003	5	PNGS CAUTION GG 9003
17	GL 4069 *	4	C+WE MASTER ALARM GL 4069
18			
19			
20			
21			
22	GN 7557 *	5	LR VEL DATA NO GOOD GN 7557
23	GN 7584 *	4	LR MODE CONTROL GN 7684
24	GN 7533 *	4	LR LGC ANT 1 POS CMD GN 7533
25	GN 7576 *	4	LR ANT POS NO. 1 GN 7576
26	GN 7577 *	4	LR ANT POS NO. 2 GN 7577
27	GN 7521 *	5	LR RANGE DATA NO GOOD GN 7521
28	GN 7615 *	4	RR AUTO ANG TRK EN GN 7615
29	GN 7621 *	5	RR NO TRACK GN 7621
30	GN 7636 *	4	RR LO SCALE FACTOR GN 7636
31	GN 7637 *	4	RR PWR ON MODE SW IN LGC GN 7637
32			TIMING
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

* These measurements are not controlled by this specification but are included for reference only.

EVENT RECORDER SIGNAL ARRANGEMENT

FIGURE 4A

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			TIMING
2	GG 1523	5	+28 VDC LGC OPER GG 1523
3	GG 1513	5	+28 VDC IMU STBY GG 1513
4			
5			
6			
7			
8			
9			
10			
11	GG 2302		IMU HEATER CUR GG 2302
12	GG 2303		IMU BLOWER CUR GG 2303
13			
14	GG 9001	5	LGC WARNING GG 9001
15	GG 9002	5	ISS WARNING GG 9002
16	GG 9003	5	PGNS CAUTION GG 9003
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			TIMING
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

EVENT RECORDER SIGNAL ARRANGEMENT

FIGURE 4B

3.8 ANALOG RECORDER SIGNAL ARRANGEMENT. The signals recorded on the Analog Recorder shall be arranged as specified in Table VII.

TABLE VII

ANALOG RECORDER SIGNAL ARRANGEMENT

LM	CONSOLE/PANEL		
	004A1		004A3
	Analog Module		Analog Module
	A2	A3	A2
1	Fig. 5A	Fig. 5B	Fig. 5C
2	Fig. 5A	Fig. 5B	Fig. 5C
3	Fig. 5A	Fig. 5B	Fig. 5C
4	Fig. 5A	Fig. 5B	Fig. 5C
LTA8-M	Fig. 5A	Fig. 5E	Fig. 5D

1	2	3
IG SERVO ERR IN PH GG 2107	IG TORQUE MTR CUR GG 2110	MG SERVO ERR IN PH GG 2137
Measurement No. GG 2107 Link No. 5	Measurement No. GG 2110** Link No. 5	Measurement No. GG 2137 Link No. 5

4	5	6
MG TORQUE MTR CUR GG 2140**	OG SERVO ERR IN PH GG 2167	OG TORQUE MTR CUR GG 2170**
Measurement No. GG 2140 Link No. 5	Measurement No. GG 2167 Link No. 5	Measurement No. GG 2170 Link No. 5

7	8
PIPA TEMP GG 2300	IRIG TEMP GG 2301*
Measurement No. GG 2300 Link No. 5	Measurement No. GG 2301 Link No. 5

*Not applicable LM4
**Use link 4 for LM4

8 CHANNEL ANALOG RECORDER SIGNAL ARRANGEMENT A

FIGURE 5A

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 2220	4	IG CDU FINE ERROR GG 2220
1	2	GG 2001	5	X PIP SG OUT IN PH GG 2001
1	3	GG 1020	4	+ 14V LGC SUP GG1020
1	4	GG 3312	4	RR SHAFT CDU COARSE ER GG 3312
2	1	GG 2250	4	MG CDU FINE ERROR GG 2250
2	2	NG 1521	4	+28 VDC LGC OPR NOISE NG 1521
2	3	GG 1030	4	+4V LGC SUP GG 1030
2	4	GG 3322	4	RR TRUN CDU COARSE ER GG 3322
3	1	GG 2280	4	OG CDU FINE ERROR GG 2280
3	2	GG 2021	5	Y PIP SG OUT IN PH GG 2021
3	3	GG 1070	4	+4 VDC CDU PWR SUP GG 1070
3	4	GG 3311	4	RR SHAFT CDU FINE ER GG 3311
4	1	GG 2219	5	PITCH ATT ER DAC OUT GG 2219
4	2	NG 1501	4	+28 VDC IMU OPR NOISE NG 1501
4	3	GG 1201	5	IMU 28V 1% 800 CPS GG 1201
4	4	GG 3321	4	RR TRUN CDU FINE ER GG 3321
5	1	GG 2249	5	YAW ATT ER DAC OUT GG 2249
5	2	GG 2041	5	Z PIP SG OUT IN PH GG 2041
5	3	GG 1202	4	IMU .8 KC 5% -90 DEG GG 1202
5	4	GG 3324	5	RR TRUN IX RES OUT SIN GG 3324
6	1	GG 2279	5	ROLL ATT ER DAC OUT GG 2279
6	2	NG 1511	4	+28 VDC IMU STB NOISE NG 1511
6	3	GG 1203	4	IMU .8 KC 5% 0 DEG GG 1203
6	4	GG 3325	5	RR TRUN IX RES OUT COS GG 3325
7	1	GG 1331	5	3.2 KC 28V SUP 1% GG 1331
7	2	GG 1040	5	+120 VDC PIPA SUP GG1040
7	3	GG 1510	4	+28V IMU STBY GG 1510
7	4	GG 3304	5	RR SHAFT IX OUT SIN GG 3304
8	1	NG 1342*		HIGH RATE MEASUREMENTS
8	2	GG 1500	4	+28V IMU OPER GG 1500
8	3	GG 1520	4	+28V LGC OPER GG 1520
8	4	GG 3305	5	RR SHAFT IX OUT COS GG 3305
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

*NG 1342 is a dummy measurement number depicting a high rate assignment.

ANALOG RECORDER SIGNAL ARRANGEMENT B

FIGURE 5B

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 2112	5	IG IX RSVR OUT SIN GG 2112
1	2	GG 2166	4	OG SERVO ERROR TOTAL GG 2166
1	3	NG 1501	4	+28V IMU OPER NOISE NG 1501
1	4	GN 7567 *	4	GAIN STATE 01 GN 7567
2	1	GG 2113	5	IG IX RSVR OUT COS GG 2113
2	2	GG 2281	4	OG CDU COARSE ERROR GG 2281
2	3	NG 1521	4	+28V LGC OPER NOISE NG 1521
2	4	GN 7568 *	4	GAIN STATE 02 GN 7568
3	1	GG 2142	5	MG IX RSVR OUT SIN GG 2142
3	2	GG 2106	4	IG SERVO ERROR TOTAL GG 2106
3	3	GG 2181**	5	OG IX OUT SIN 11 DEG GG 2181
3	4	GN 7569 *	4	GAIN STATE 03 GN 7569
4	1	GG 2143	5	MG IX RSVR OUT COS GG 2143
4	2	GG 2221	4	IG CDU COARSE ERR GG 2221
4	3	GG 6020***	5	PIP CAL MOD TEMP GG 6020
4	4	GN 7570 *	4	GAIN STATE 04 GN 7570
5	1	GG 2172	5	OG IX RSVR OUT SIN GG 2172
5	2	GG 2136	4	MG SERVO ERROR TOTAL GG 2136
5	3	GG 2121**	5	IG IX OUT SIN 11 DEG GG 2121
5	4	GN 7647 *	4	ATM OUT SHAFT GN 7647
6	1	GG 2173	5	OG IX RSVR OUT COS GG 2173
6	2	GG 2251	4	MG CDU COARSE ERR GG 2251
6	3	GG 6021	4	PSA TEMP GG 6021
6	4	GN 7645 *	4	ATM OUT TRUN GN 7645
7	1	GG 1100	4	-28 VDC SUPPLY GG 1100
7	2	GN 7655 *	4	AC PWR 1 GN 7655
7	3	GG 2151**	5	MG IX OUT SIN 11 DEG GG 2151
7	4	GN 7563 *	5	LR ANT TEMP GN 7563
8	1	GG 1110	5	2.5 VDC TM BIAS 1 GG 1110
8	2	GN 7656 *	4	AC PWR 2 GN 7656
8	3	GG 4300	4	LGC TEMP GG 4300
8	4	GN 7723 *	5	RR ANT TEMP GN 7723
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

* These measurements are not controlled by this specification but are included for reference only.
** Not applicable LM 4
*** Use link 4 for LM4

ANALOG RECORDER SIGNAL ARRANGEMENT C

FIGURE 5C

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 3324	5	RR TRUN 1X RES OUT SIN GG 3324
1	2	GG 2001	5	X PIP SG OUT IN PH GG 2001
1	3	GG 2112	5	IG 1X RSVR OUT SIN GG 2112
1	4	GG 4300		LGC TEMP GG 4300
2	1	GG 3325	5	RR TRUN 1X RES OUT COS GG 3325
2	2	GG 2021	5	Y PIP SG OUT IN PH GG 2021
2	3	GG 2113	5	IG 1X RSVR OUT COS GG 2113
2	4	GG 6021		PSA TEMP GG 6021
3	1			
3	2	GG 2041	5	Z PIP SG OUT IN PH GG 2041
3	3			
3	4	GG 8102		IMU PAD TEMP. AVE GG 8102
4	1	GG 2219	5	PITCH ATT ER DAC OUT GG 2219
4	2	GG 2181	5	OG 1X OUT SIN 11 DEG GG 2181
4	3	GG 1201	5	IMU 28V 1% 800 CPS GG 1201
4	4	GG 8103		IMU COOLANT INLET GG 8103
5	1	GG 2249	5	YAW ATT ER DAC OUT GG 2249
5	2	GG 2121	5	IG 1X OUT SIN 11 DEG GG 2121
5	3	GG 2142	5	MG 1X RSVR OUT SIN GG 2142
5	4	GG 8116	5	AOT EXT. VIEWING LENS GG 8116
6	1	GG 2279	5	ROLL ATT ER DAC OUT GG 2279
6	2	GG 2151	5	MG 1X OUT SIN 11 DEG GG 2151
6	3	GG 2143	5	MG 1X RSVR OUT COS GG 2143
6	4	GG 8117	5	AOT EXT PRESS SEAL GG 8117
7	1	GG 1331	5	3.2KC 28V SUP 1% GG 1331
7	2	GG 1040	5	+120 VDC PIPA SUP GG 1040
7	3	GG 2172	5	OG 1X RSVR OUT SIN GG 2172
7	4	GG 3304	5	RR SHAFT 1X OUT SIN GG 3304
8	1	GG 6020	5	PIP CAL MOD TEMP GG 6020
8	2	GG 1110	5	2.5 VDC TM BIAS 1 GG 1110
8	3	GG 2173	5	OG 1X RSVR OUT COS GG 2173
8	4	GG 3305	5	RR SHAFT 1X OUT COS GG 3305
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

ANALOG RECORDER SIGNAL ARRANGEMENT D

FIGURE 5D

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 8104		PTA HDR (PIPA CAL MOD) GG 8104
1	2	GG 8108		LGC LOC 2 GG 8108
1	3	GG 8114		CDU TRAY X FRONT LEFT GG 8114
1	4			
2	1	GG 8107		LGC LOC 1 GG 8107
2	2	GG 8105		PTA HDR (PULSE TORQUE SUP) GG 8105
2	3			
2	4			
3	1	GG 8110		PSA HDR (800 C 5% PH -A SUP) GG 8110
3	2			
3	3			
3	4			
4	1	GG 8113		CDU TRAY X (4 VDC SUP) GG 8113
4	2	GG 8112		PSA HDR (GIMBAL SERVO AMP) GG 8112
4	3			
4	4			
5	1	GG 8106		PTA HDR (BINARY CUR. SW) GG 8106
5	2			
5	3			
5	4			
6	1	GG 8109		LGC LOC 3
6	2			
6	3			
6	4			
7	1	GG 8111		PSA HDR (800 C 5% PH-B SUP) GG 8111
7	2			
7	3			
7	4			
8	1	GG 8115		CDU TRAY X FRONT RIGHT GG 8115
8	2			
8	3			
8	4			
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

ANALOG RECORDER ARRANGEMENT E

FIGURE 5E

4A4A05

R-START 144				R-START 145			
			CRT ERROR RESET DG 0000	LGC DISPLAY PROGRAM DSKY G&N 622A or 622-200 DG 0001		LGC* DISPLAY RECORD G&N 624B or 624-200	
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START 146				R-START 147 *			
K-START DUMP DG 0004	K-START VERIFY DG 0003	K-START LOAD- VERIFY DG 0002		PIPA REF SELECT DG 2501	X PIPA SELECT DG 2502	Y PIPA SELECT DG 2503	Z PIPA SELECT DG 2504
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

*Not applicable LTA8-M

R-START SIGNAL ARRANGEMENT A

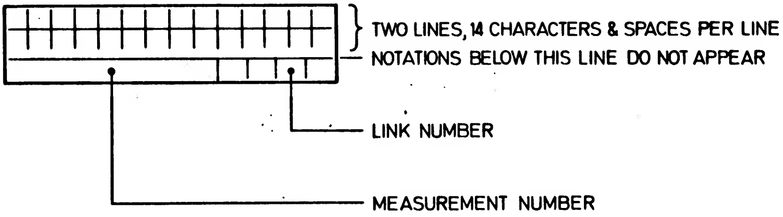
FIGURE 6A

R-START 152				R-START 153			
(D)	LGC TIME TRANS. G&N 603 DG 0007 (C)	LGC TIME CORR G&N 602 DG 0006 (B)	LGC CLOCK INITIAL G&N 601 DG 0005 (A)	(D)	(C)	(B)	(A)

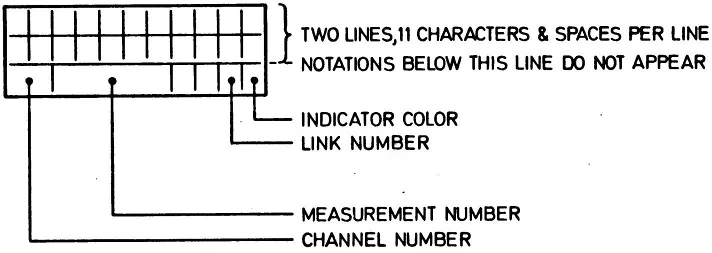
R-START 154				R-START 155			
4 VDC SUPPLY LO WG 0023 (D)	4 VDC SUPPLY HI JG 0023 (C)	14 VDC SUPPLY LO WG 0022 (B)	14 VDC SUPPLY HI JG 0022 (A)	IG STEP INPUT JG 2505 (D)	MG STEP INPUT JG 2506 (C)	OG STEP INPUT JG 2507 (B)	LGC MARGIN TEST ENABLE JG 0021 (A)

R-START SIGNAL ARRANGEMENT B

FIGURE 6B


TWO LINES, 14 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
LINK NUMBER
MEASUREMENT NUMBER

7 A. - METER IDENTIFICATION INSERT


TWO LINES, 11 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
INDICATOR COLOR
LINK NUMBER
MEASUREMENT NUMBER
CHANNEL NUMBER

7 B. - EVENT INDICATOR DISPLAY FORMAT

FIGURE 7

3.10 C-START. - The C-START (C-156) arrangement for each LM shall be as specified in Table IX.

TABLE IX

C-START

	CODE NO.	STIMULUS NO.	CODE NO.	STIMULUS NO.	CODE NO.	STIMULUS NO.
	1	DG 0009				
*	2	DG 9102				
*	3	ZG 0022				
*	4	ZG 0023				

	CODE NO.	SUB-PROGRAM	C-START ENTRY
	31	G&N 631	00000XXX
*	20	G&N 641	XX000000
*		G&N 601 CODES 90, 91, 70, 80, 71	XXXXXXXX

*Not applicable to LTA8-M

4. QUALITY ASSURANCE PROVISIONS

4.1 INSPECTION. The requirements specified in Section 3 shall be verified by visual inspection.

5. PREPARATION FOR DELIVERY. - This section is not applicable to this specification.

6. NOTES.

6.1 VARIATIONS TO SIGNAL ARRANGEMENT. Signal arrangements within a display module or assembly may be varied, but the signals shall be retained by the original module or assembly specified. The signal arrangement for the CRT display (3.4) shall be restricted to variations within the half page specified.

6.2 SPACECRAFT LOCATION. The letter following the LM vehicle number indicates the location of the vehicle. Locations are as follows:

	Applicable at
-G	Grumman Aircraft
-K	KSC
-M	MSC
No letter	Applicable at all locations

6.3 NOMENCLATURE VARIANCE. Nomenclature may be varied by the user in Sections 3.5 thru 3.8, however, the measurement number must always be a portion of the nomenclature.

APOLLO G&N Specification
ND1002322 REV D
Original Issue Date:
Release Authority: TDRR 31355
Class A **Release**
CODE IDENT NO. 99974

G&N PROGRAMMING REQUIREMENTS
(DISPLAYS & CONTROLS)
FOR
ACCEPTANCE CHECKOUT EQUIPMENT
(LM)

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals AC	Approvals NASA
Ⓜ 10/27/66	A	31659	3-33. Was 33 pages, now	EA	WLS
			36 pages. RD6/AC		
Ⓜ 11/15/66	B	31947	2-49 was 36 pages, now 49 pages RD6/AC	EA	- -
Ⓜ 1/6/67	C	32583	3, 5-10, 12, 16-49, was 49 pages,	EA	--
			now 41 pages. RD6/AC		
1/19/67	D	32698	3 RD6/AC	EA	--

This specification consists of page 1 to 41 inclusive.

APPROVALS	NASA/MSC		AC	

3. REQUIREMENTS

3.1 G&N LM SUBPROGRAMS. The subprograms contained in Specification ND1002319 shall be used for the applicable LM configuration as specified in Table I.

TABLE I

SUBPROGRAMS

LM VEHICLE (Use Subprogram Indicated with "X")	AC ELECTRONICS G&N SUBPROGRAMS															
	601	602	603	621	621-200	622A	622-200	624A	624B	624-200	631	632	641	152A	671	681
LTA8-M				X		X			X		X	X			X	
LM1-G	X	X	X	X		X		X			X	X	X	X	X	X
LM1-K*	X	X	X		X		X			X	X	X	X	X	X	X
LM2-G	X	X	X	X		X		X			X	X	X	X	X	X
LM2-K	X	X	X	X		X			X		X	X	X	X	X	X
LM3-	X	X	X	X		X			X		X	X	X	X	X	X
LM4-G				X		X			X		X	X	X	X	X	X

*If flight ropes not available, use same subprograms as LM1-G.

3.2 SIGNAL BLINK LIMITS. The following signal blink limits shall apply to all G&N LM.

a. The following signals shall have blink limits equal to tolerances specified in the applicable LM Operational Checkout Procedure.

GG 1020
GG 1030
GG 1040
GG 1070
GG 1100

GG 1110
GG 1201
GG 1202
GG 1203
GG 1331

NG 1336
GG1500
GG 1510
GG 1520

APOLLO G&N Specification
ND1002322 REV E
Original Issue Date:
Release Authority: TDRR 31355
Class A Release
CODE IDENT NO. 99974

G&N PROGRAMMING REQUIREMENTS

(DISPLAYS & CONTROLS)

FOR

ACCEPTANCE CHECKOUT EQUIPMENT

(LM)

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
				AC	NASA
Ⓜ 10/27/66	A	31659	~~3-33~~. Was 33 pages, now	EA	WLS
			36 pages. RDG/AC		
Ⓜ 11/15/66	B	31947	2-49 was 36 pages, now 49 pages RDG/AC	EA	--
Ⓜ 1/6/67	C	32583	3, 5-10, 12, 16-49, was 49 pages,	EA	--
			now 41 pages. RDG/AC		
Ⓜ 1/19/67	D	32698	3 RDG/AC	EA	--
2/2/67	E	32893	3	EA	--

This specification consists of page 1 to 41 inclusive.

APPROVALS	NASA/MSC				AC

3. REQUIREMENTS

3.1 G&N LM SUBPROGRAMS. The subprograms contained in Specification ND1002319 shall be used for the applicable LM configuration as specified in Table I.

TABLE I

SUBPROGRAMS

LM VEHICLE (Use Subprogram Indicated with "X")	AC ELECTRONICS G&N SUBPROGRAMS															
	601	602	603	621	621-200	622A	622-200	624A	624B	624-200	631	632	641	152A	671	681
LTA8-M				X		X			X		X	X			X	
LM1-G	X	X	X	X		X		X			X	X	X	X	X	X
LM1-K*	X	X	X		X		X			X	X	X	X	X	X	X
LM2-G	X	X	X	X		X		X			X	X	X	X	X	X
LM2-K	X	X	X	X		X			X		X	X	X	X	X	X
LM3-	X	X	X	X		X			X		X	X	X	X	X	X
LM4-G				X		X			X		X	X	X	X	X	X

*If flight ropes not available, use same subprograms as LM3.

3.2 SIGNAL BLINK LIMITS. The following signal blink limits shall apply to all G&N LM.

a. The following signals shall have blink limits equal to tolerances specified in the applicable LM Operational Checkout Procedure.

GG 1020
GG 1030
GG 1040
GG 1070
GG 1100
GG 1110
GG 1201
GG 1202
GG 1203
GG 1331
NG 1336
GG1500
GG 1510
GG 1520

APOLLO G&N Specification
ND1002322 REV F
Original Issue Date:
Release Authority: TDRR 31355
Class A Release
CODE IDENT NO. 99974

G&N PROGRAMMING REQUIREMENTS

(DISPLAYS & CONTROLS)

FOR

ACCEPTANCE CHECKOUT EQUIPMENT

(LM)

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
				AC	NASA
Ⓜ 10/27/66	A	31659	3-33. Was 33 pages, now	EA	WLS
			36 pages. RDG/AC		
Ⓜ 11/15/66	B	31947	2-49 was 36 pages, now 49 pages RDG/AC	EA	- -
Ⓜ 1/6/67	C	32583	3, 5-10, 12, 16-49, was 49 pages,	EA	--
			now 41 pages. RDG/AC		
Ⓜ 1/19/67	D	32698	3 RDG/AC	EA	--
Ⓜ 2/2/67	E	32893	3 JH/AC	EA	--
5/9/67	F	33742	All, Specification was 41 pages	EA	--
			now 55 pages. JH/AC		

This specification consists of page 1 to 55 inclusive.

APPROVALS	NASA/MSC		AC

3. REQUIREMENTS

3.1 G&N LM SUBPROGRAMS. The subprograms contained in Specification ND1002319 shall be used for the applicable LM configuration as specified in Table I.

TABLE I

SUBPROGRAMS

LM VEHICLE (Use Subprogram Indicated with "X")	AC ELECTRONICS G&N SUBPROGRAMS															
	601	602	603	621	621-200	622A	622-200	624A	624B	624-200	631	632	641	152A	671	681
LTA8-M				X		X			X		X				X	
LM1-G	X	X	X	X		X		X			X	X	X	X	X	X
LM1-K*	X	X	X		X		X			X	X	X	X	X	X	X
LM2-G	X	X	X	X		X		X			X	X	X	X	X	X
LM2-K*	X	X	X		X		X			X	X	X	X	X	X	X
LM3-K	X	X	X	X		X			X		X	X	X	X	X	X
LM4-G, LM3-G				X		X			X		X		X	X	X	X

*If flight ropes not available, use same subprograms as LM3-K.

3.2 SIGNAL BLINK LIMITS. The following signal blink limits shall apply to all G&N LM.

a. The following signals shall have blink limits equal to tolerances specified in the applicable LM Operational Checkout Procedure.

GG 1020
GG 1030
GG 1040
GG 1070
GG 1100

GG 1110
GG 1201
GG 1202
GG 1203
GG 1331

NG 1336
GG1500
GG 1510
GG 1520

TABLE IV

CRT DISPLAY ASSIGNMENT MEASUREMENT LIST *

SIGNAL NUMBER	CRT FIG. 1 -LINE	SIGNAL NUMBER	CRT FIG. 1 -LINE
GG 1020	A-15, K-15, R-3	GG 2173	W-17, B-8, G-5, L-8,R-20
1030	A-16, K-16, R-4	2172/2173**	B-15, L-15, S-22, U-22
1040	A-20, G-21, K-20, R-8, V-15	2181	W-15, B-17, G-3, L-17, S-24, U-24
1070	A-19, K-19, R7	2219	W-22, B-16, G-12, L-16, S-23, U-23
1100	A-21, K-21, R-9	2220	B-10, L-10, R-22
1110	A-22, G-20, K-22, R-10, V-14	2221	B-9, L-9, R-21
1201	A-21, G-21, K-21, R-9, V-15	2249	W-22, B-16, G-12, L-16, S-23, U-23
1202	A-22, K-22, R-10	2250	B-10, L-10, R-22
1203	A-23, K-23, R-11	2251	B-9, L-9, R-21
1331	A-24, G-20, K-24, R-12, V-14	2279	W-22, B-16, G-12, L-16, S-23, U-23
1500	A-18, K-18, R-6	2280	B-10, L-10, R-22
1510	A-17, K-17, R-5	2281	B-9, L-9, R-21
1520	A-14, K-14, R-2	2300	V-19, B-24, G-24, L-24, S-19, U-19
2001	W-20, B-3, G-8, L-3, R-15	2301	V-18, B-24, G-24, L-24, S-19, U-19
2021	W-20, B-3, G-8, L-3, R-15	3304	E-2, T-17
2041	W-20, B-3, G-8, L-3, R-15	3305	E-3, T-18
2106	B-5, L-5, R-17	3304/3305**	E-4, T-19
2107	W-19, B-6, G-7, L-6, R-18	3311	E-5, T-21
2110	W-18, B-4, G-6, L-4, R-16	3312	E-7, T-22
2112	W-16, B-7, G-4, L-7, R-19	3321	E-6, T-21
2113	W-17, B-8, G-5, L-8, R-20	3322	E-7, T-22
2112/2113**	B-15, L-15, S-22, U-22	3324	E-2, T-17
2121	W-15, B-17,,G-3, L-17, S-24, U-24	3325	E-3, T-18
2136	B-5, L-5, R-17	3324/3325**	E-4, T-19
2137	W-19, B-6, G-7, L-6, R-18	4300	E-21, L-12, R-24
2140	W-18, B-4, G-6, L-4, R-16	6020	E-21, L-12, R-24
2142	W-16, B-7, G-4, L-7, R-19	GG 6021	E-21, G-23+, L-12, R-24, V-17
2143	W-17, B-8, G-5, L-8, R-20	NG 1021	A-15, K-15, R-3
2142/2143**	B-15, L-15, S-22, U-22	1031	A-16, K-16, R-4
2151	W-15, B-17, G-3, L-17, S-24, U-24	1071	A-19, K-19, R-7
2166	B-5, L-5, R-17	1336	A-24, K-24, R-12
2167	W-19, B-6, G-7, L-6, R-18	1501	A-18, K-18, R-6
2170	W-18, B-4, G-6, L-4, R-16	1511	A-17, K-17, R-5
2172	W-16, B-7, G-4, L-7, R-19	NG 1521	A-14, K-14, R-2

NOTE: * Whenever a choice between LINK 4 or LINK 5 exists, use LINK 5.
** Processed by G&N 152A
+ Supplementary measurement, LTA8-M only.

SCOPE SPACING CHART FOR PAGE DISPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
AA																																								
1	0	1			I	S	S		M	E	A	S						X	/	O	G				Y	/	I	G				Z	/	M	G					
2	0	2		C	D	U		A	N	G	L	E				X	X	X	.	X	X		X	X	X	.	X	X		X	X	X	.	X	X			D	E	G
3	0	3		1	X		S	I	N		1	1	°					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G
4	0	4		1	X		R	S	V	R		S	I	N				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S
5	0	5		1	X		R	S	V	R		C	O	S				X	X	.	X				X	X	.	X				X	X	.	X		V	R	M	S
6	0	6		T	O	R		M	O	T		C	U	R				.	X	X	X				.	X	X	X				.	X	X	X		A	M	P	S
7	0	7		S	E	R	V	O		E	R		ø					X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
8	0	8		P	I	P	A		S	G		ø						X	.	X	X				X	.	X	X				X	.	X	X		V	R	M	S
9	0	9		P	I	P	A		C	T	R						X	X	X	X	X			X	X	X	X	X			X	X	X	X	X					
10	1	0																																						
11	1	1			I	S	S		M	E	A	S					X	/	Y	A	W		Y	/	P	I	T	C	H		Z	/	R	O	L	L				
12	1	2		D	A	C		A	T	T		E	R					X	X	.	X				X	X	.	X				X	X	.	X			D	E	G
13	1	3		T	E	M	P		I	N		L	I	M				X	X		I	M	U		O	P	E	R	A	T	E							X	X	
14	1	4		Z	E	R	O		I	C	D	U						X	X		I	S	S		T	R	N	O	N		R	Q	S	T				X	X	
15	1	5		I	N	I	T		I	S	S							X	X		I	S	S		T	R	N	O	N		C	O	M	P				X	X	
16	1	6		I	M	U		C	A	G	E							X	X		C	D	U		C	O	N	T	R	O	L							X	X	
17	1	7		I	S	S		E	R	R		C	T	R				X	X		D	S	P		I	N	R	T	L		D	A	T	A				X	X	
18	1	8		C	O	R	S	E		A	L	I	G	N				X	X		N	O		A	T	T	I	T	U	D	E							X	X	
19		G	G				S	U	P	P	L	Y					V	D	C			G	G				S	U	P	P	L	Y				V	R	M	S	
20	1	1	1	0		T	M		B	I	A	S				X	.	X	X		1	3	3	1		2	8	V	3	.	2	K	C			X	X	.	X	
21	1	0	4	0		1	2	0		P	I	P				X	X	X			1	2	0	1		I	M	U		1	%	0				X	X	.	X	
22																																								
23	6	0	2	1		P	S	A		T	E	M	P		X	X	X	.	X		°	F																		
24	2	4		I	R	I	G		T	E	M	P				X	X	X	.	X	°	F		P	I	P	A		T	E	M	P		X	X	X	.	X	°	F
25																																								

CRT DISPLAY

FIGURE 1G

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	G	G	8	1			T		T	E	M	P			D	E	G	F		G	G	8	1			T		T	E	M	P					D	E	G	F	
2	0	2		I	M	U		P	A	D		A	V	E		X	X	X		1	3		C	D	U		T	R	A	Y		X	4	V			X	X	X	
3	0	3		I	M	U		C	O	O	L		I	N			X	X		1	4		C	D	U		T	R	A	Y		X	F	L			X	X	X	
4	0	4		P	T	A		H	D	R		P	C	M		X	X	X		1	5		C	D	U		T	R	A	Y		X	F	R			X	X	X	
5	0	5		P	T	A		H	D	R		P	T	S		X	X	X		1	6		A	O	T		E	X	T		L	E	N	S			X	X	X	
6	0	6		P	T	A		H	D	R		B	C	S		X	X	X		1	7		A	O	T		E	X	T		P	R	S	L			X	X	X	
7	0	7		L	G	C		L	O	C		1				X	X	X																						
8	0	8		L	G	C		L	O	C		2				X	X	X																						
9	0	9		L	G	C		L	O	C		3				X	X	X																						
10	1	0		P	S	A		H	D	R		P	H	A		X	X	X																						
11	1	1		P	S	A		H	D	R		P	H	B		X	X	X																						
12	1	2		P	S	A		H	D	R		G	S	A		X	X	X																						
13																																								
14																																								
15																																								
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23																																								
24																																								
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT J

FIGURE 1J

SCOPE SPACING CHART
FOR PAGE DISPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
AA																																									
1	0	1					A	C	T	I	V	I	T	Y							P	R	O	G	R	A	M				V	E	R	B		N	O	U	N		
2	0	2		U	P	L	I	N	K		C	O	M	P	U	T	E	R					X	X								X	X				X	X			
3	0	3		I	S	S		M	O	D	E		X	X	X	X	X	X											R	1			X	X	X	X	X				
4	0	4		I	N	H	I	B		U	P	L	I	N	K			X	X										R	2			X	X	X	X	X				
5	0	5		B	L	O	C	K		U	P	L	I	N	K			X	X										R	3			X	X	X	X	X				
6	0	6		U	P	L	O	C	K									X	X		K	E	Y		R	E	L	E	A	S	E							X	X		
7	0	7		L	G	C		W	A	R	N	I	N	G				X	X		O	P	E	R	A	T	O	R		E	R	R						X	X		
8	0	8		G	I	M	B	A	L		L	O	C	K				X	X		P	R	O	G	R	A	M			A	L	M						X	X		
9	0	9		I	S	S					F	A	I	L				X	X		T	E	M	P		C	A	U	T	I	O	N						X	X		
10	1	0		P	I	P	A				F	A	I	L				X	X		R	E	D	O	C	T	R						X	X	X	X	X				
11	1	1		I	S	S	C	D	U		F	A	I	L				X	X		L	M	P	C	M	D							X	X	X	X	X				
12	1	2		R	R		C	D	U		F	A	I	L				X	X		F	A	I	L	R	E	G						X	X	X	X	X				
13	1	3		W	O	R	D		E	R	R		X	X	X	X	X	X	X		O	S	C		A	L	A	R	M									X	X		
14	1	4		S	Y	N	C		E	R	R							X	X		T	R	A	C	K	E	R		F	A	I	L						X	X		
15	1	5		R	E	L			E	R	R							X			T	E	S	T		A	L	A	R	M	S							X	X		
16	1	6		K	E	Y			E	R	R							X	X		A	B	L		L	G	C		S	T	B	Y						X	X		
17	1	7		P	A	R			E	R	R							X			P	I	P	A		M	E	A	S								X	X	X		*
18	1	8																			H	I		R	A	T	E							G	G	X	X	X	X		*
19	1	9		U	P	L	I	N	K		F	A	S	T				X	X		I	G	N	I	C	D	U		F	A	I	L					X	X			
20	2	0		I	G	N	P	I	P			F	A	I	L			X	X		G	N		T	R		C	O	N	T	R	L			X	X	X		M	S	
21	2	1		I	G	N	I	M	U			F	A	I	L			X	X																						
22	2	2																			F	S				E	R	R	O	R			X								*
23	2	3																																							
24	2	4		L	G	C		T	I	M	E			X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X			S	E	C		
25																																									

*No FS error display required if ADAP routine for G&N 681; N/A for LTA8-M

CRT DISPLAY

FIGURE 1Q

**SCOPE SPACING CHART
FOR PAGE DISPLAY**

AA																																								
1	0	1		F	O	R	V	E	L		X	X	X	·	X	X		F	P	S		L	A	T	V	E	L			X	X	X	·	X	X		F	P	S	
2	0	2		A	L	T		R	A	T	E				X	X	X	X	·	X		F	P	S																
3	0	3		L	R		A	L	T		F	T											X	X	X	X	X	X	X	X	X	X	·	X	X	X				
4	0	4		L	R		V	X															X	X	X	X	X	X	X	X	X	X	·	X	X	X	X			
5	0	5		L	R		V	Y															X	X	X	X	X	X	X	X	X	X	·	X	X	X	X			
6	0	6		L	R		V	Z																X	X	X	X	X	X	X	X	X	·	X	X	X	X			
7	0	7		A	L	T	S	A	V	E			D	P									X	X	X	X	X	X	X	X	X	·	X	X	X		F	E	E	T
8	0	8		F	I	N	A	L	T				D	P									X	X	X	X	X	X	X	X	X	·	X	X	X		F	E	E	T
9	0	9		R	R		R	A	N	G	E												X	X	X	X	X	X	X	X	X	X	·	X	X		F	E	E	T
10	1	0		R	R		R	A	N	G	E		R	A	T	E							X	X	X	X	X	X	X	X	X	·	X	X	X		F	P	S	
11	1	1			R	R		S	H	A	F	T											R	R		T	R	U	N	N	I	O	N							
12	1	2		C	D	U		∠		D	E	G		X	X	X	·	X	X		C	D	U		∠		D	E	G			X	X	·	X	X	X			
13		G	G				S	U	P	P	L	Y					V	D	C			G	G				S	U	P	P	L	Y				V	R	M	S	
14	1	1	1	0		T	M		B	I	A	S				X	·	X	X		1	3	3	1		2	8	V	3	·	2	H				X	X	·	X	
15	1	0	4	0		1	2	0		P	I	P				X	X	X			1	2	0	1		I	M	U		1	%	0				X	X	·	X	
16						T	E	M	P						D	E	G		F																					
17	6	0	2	1		P	S	A							X	X	X	·	X																					
18	2	3	0	1		I	R	I	G						X	X	X	·	X																					
19	2	3	0	0		P	I	P	A						X	X	X	·	X																					
20																																								
21																																								
22																																								
23																																								
24																																								
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FIGURE 1V

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1		I	S	S		M	O	D	E			X	X	X	X	X	X		P	R	O	G	R	A	M				V	E	R	B		N	O	U	N	
2	0	2		R	E	D	O	C	T	R					X	X	X	X	X				X	X								X	X				X	X		
3	0	3		W	O	R	D		E	R	R		X	X	X	X	X	X	X										R	1			X	X	X	X	X			
4	0	4		L	M	P	C	M	D						X	X	X	X	X										R	2			X	X	X	X	X			
5	0	5		F	A	I	L	R	E	G					X	X	X	X	X										R	3			X	X	X	X	X			
6	0	6		R	E	L			E	R	R								X		G	N		T	R		C	O	N	T	R	L			X	X	X		M	S
7	0	7		S	Y	N	C		E	R	R							X	X		K	E	Y		E	R	R	O	R							X	X			
8	0	8		P	A	R			E	R	R								X																					
9	0	9		L	G	C		T	I	M	E			X	X	X	X		H	R	S		X	X		M	I	N		X	X	·	X	X			S	E	C	·
10	1	0		A	N	G	X	/	P	I	P	E		X	X	X	X	X			V	D	R	I	F	T	O			X	X	X	·	X	X		M	E	R	U
11	1	1		A	N	G	Y	/	P	I	P	N		X	X	X	X	X			S	D	R	I	F	T	I			X	X	X	·	X	X		M	E	R	U
12	1	2		A	N	G	Z							X	X	X	X	X			E	D	R	I	F	T	T			X	X	X	·	X	X		M	E	R	U
13	1	3			I	S	S		M	E	A	S		X	/	O	G	/	Y	A	W		Y	/	I	G	/	P		Z	/	M	G	/	R	O	L	L		
14	1	4		C	D	U		A	N	G	L	E				X	X	X	·	X	X		X	X	X	·	X	X		X	X	X	·	X	X			D	E	G
15	1	5		1	X		S	I	N		1	1	°					X	X	·	X				X	X	·	X				X	X	·	X			D	E	G
16	1	6		1	X		R	S	V	R		S	I	N				X	X	·	X				X	X	·	X				X	X	·	X		V	R	M	S
17	1	7		1	X		R	S	V	R		C	O	S				X	X	·	X				X	X	·	X				X	X	·	X		V	R	M	S
18	1	8		T	O	R		M	O	T		C	U	R				·	X	X	X				·	X	X	X				·	X	X	X		A	M	P	S
19	1	9		S	E	R	V	O		E	R	R		0				X	·	X	X				X	·	X	X				X	·	X	X		V	R	M	S
20	2	0		P	I	P	A		S	G		0						X	·	X	X				X	·	X	X				X	·	X	X		V	R	M	S
21	2	1		P	I	P	A		C	T	R						X	X	X	X	X			X	X	X	X	X			X	X	X	X	X			P	L	S
22	2	2		D	A	C		A	T	T		E	R	R				X	X	·	X				X	X	·	X				X	X	·	X			D	E	G
23	2	3																																					
24	2	4																																					
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

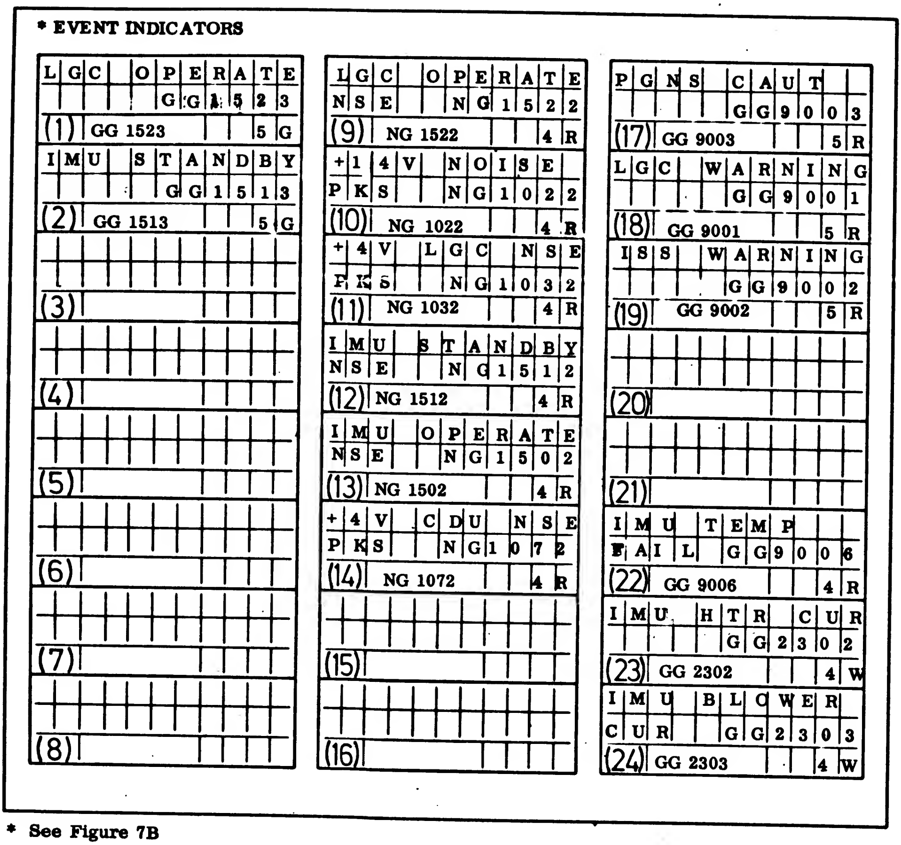
FIGURE 1W

3.6 EVENT INDICATOR DISPLAYS. The event indicator display format assignment for each LM shall be as specified in Table V.

TABLE V

EVENT INDICATOR DISPLAYS

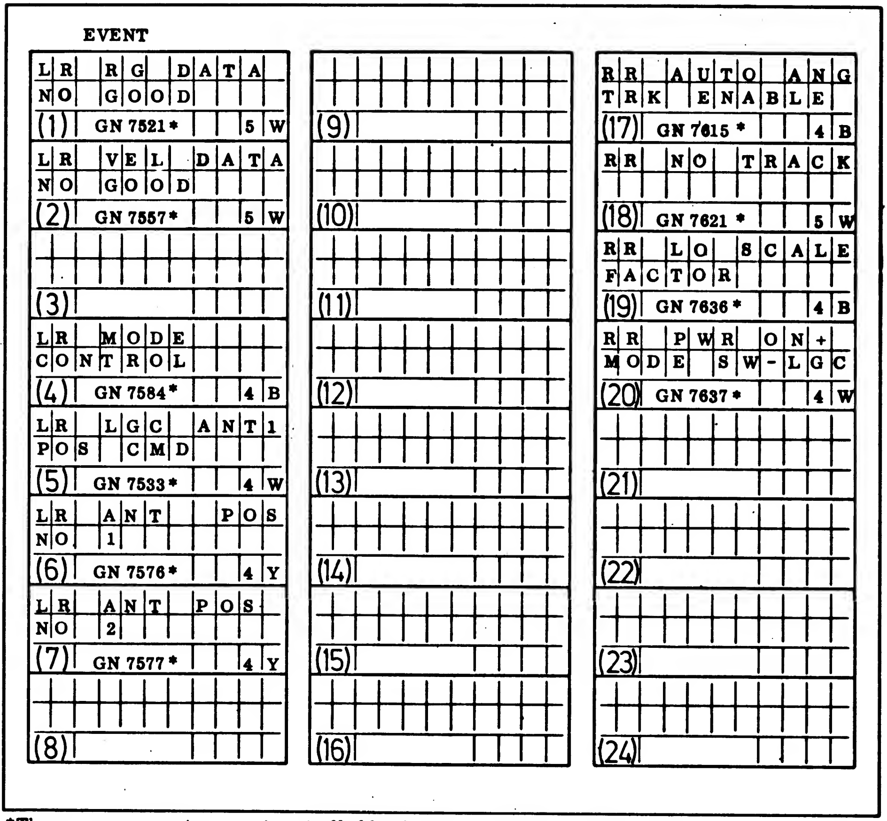
TYPE	LM	CONSOLE/PANEL					
		004A3		014A1		004A4	
		Event	Module	Event	Module	Event	Module
		A4 Figure 3	A5 Figure 3	A1 Figure 3	A2 Figure 3	A3 Figure 3	
I	1	A	B	B	A		
I	2	A	B	B	A		
I	3	A	B	B	A		
I	4	A	B	B	A		
I	LTA8-M	C					
II	1-K	E	F	H	G	D	
II	2-K	E	F	H	G	D	
II	3-G	E	F	H	G	D	
II	4-G	E	F	H	G	D	
II	LTA8-M	E	F	H	G	D	



* See Figure 7B

EVENT INDICATOR DISPLAY

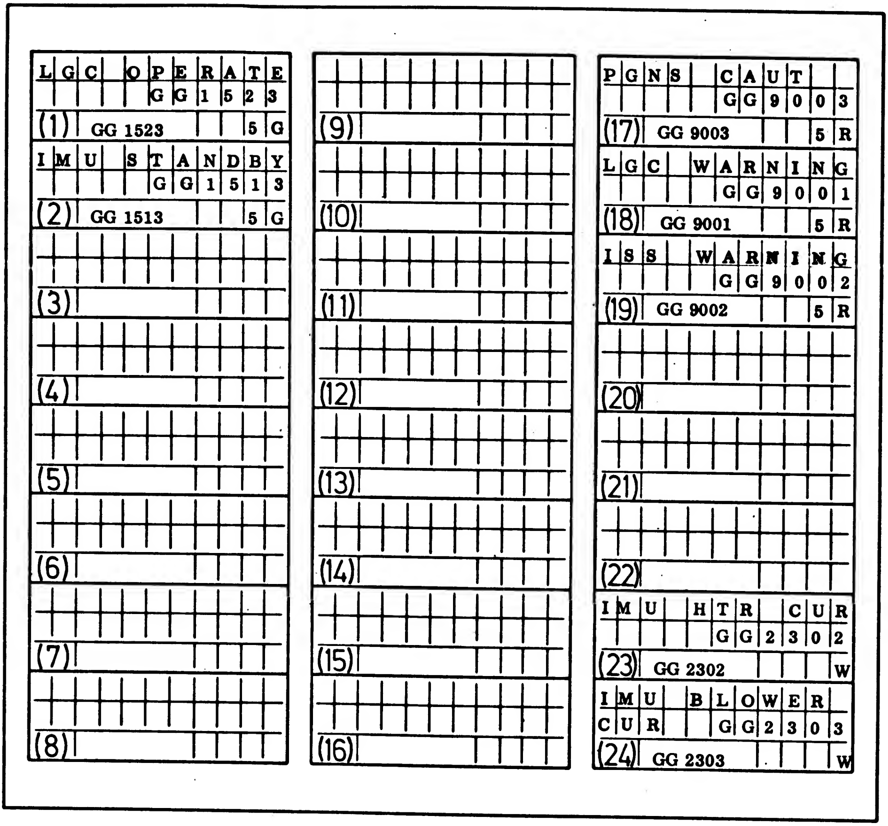
FIGURE 3A



*These measurements are not controlled by this specification but are included for reference only

EVENT INDICATOR DISPLAY

FIGURE 3B



EVENT INDICATOR DISPLAY

FIGURE 3C

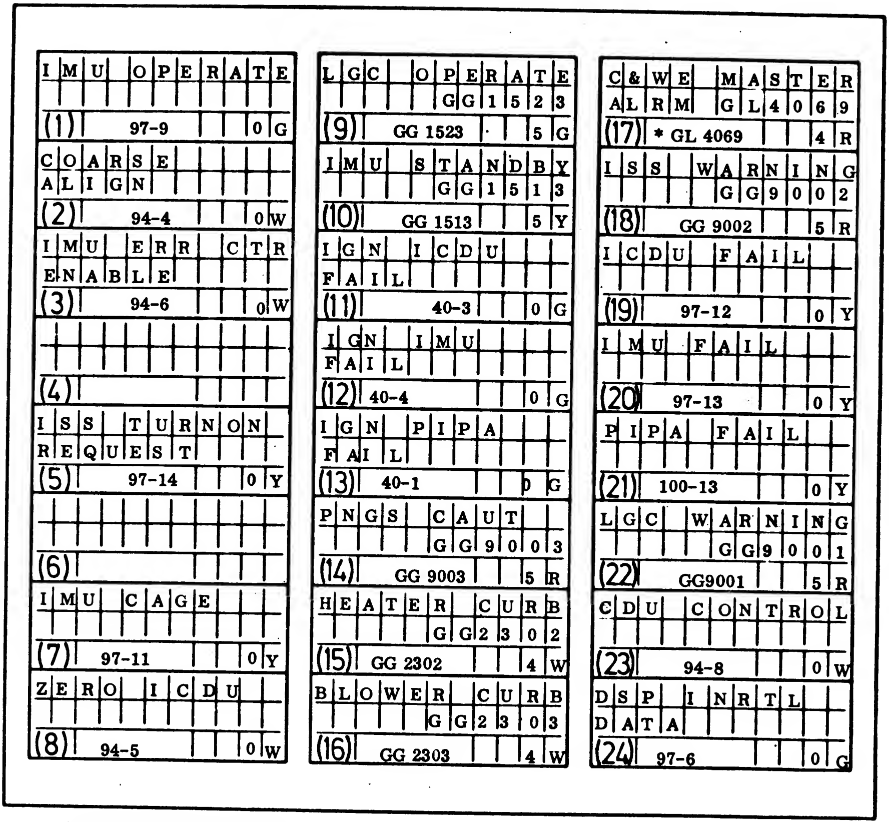
(1)	UPLINK	ACTY	*93-3	0	W
(2)	NO ATT		90-4	0	W
(3)	STBY		95-11	0	Y
(4)	KEY REL		93-5	0	W
(5)	OPER ERR		93-7	0	W
(6)	UPLOCK		77-1	0	Y
(7)	BLOCK	UPLINK	100-10	0	W
(8)	TEST ALARMS		95-10	0	W
(9)	TEMP		93-4	0	Y
(10)	GIMBAL LOCK		90-6	0	Y
(11)	PROG		90-9	0	Y
(12)					
(13)	TRACKER		90-8	0	Y
(14)	OSC ALARM		100-15	0	R
(15)	KSEQ OK		**632	0	G
(16)	KSEQ NOGOOD		**632	0	B
(17)	COMPUTER	ACTIVITY	93-2	0	W
(18)	NOISE P IMU	STBY NG1512	***NG 1512	4	R
(19)	NOISE P IMU	OPER NG1502	***NG 1502	4	R
(20)	NOISE P CDU	4VDC NG1072	***NG 1072	4	R
(21)	NOISE P LGC	28V NG1522	***NG 1522	4	R
(22)	NOISE P LGC		***NG 1022	4	R
(23)	NOISE P LGC	4VDC NG1032	***NG 1032	4	R
(24)					

* Indicates Word-Bit of G&N Subprogram 624B. (See G&N 624-200 for appropriate word-bit for LM1-K and LM2-K.)

** Not applicable LM3-G, LM4-G, LTA8-M

*** Not applicable LTA8-M

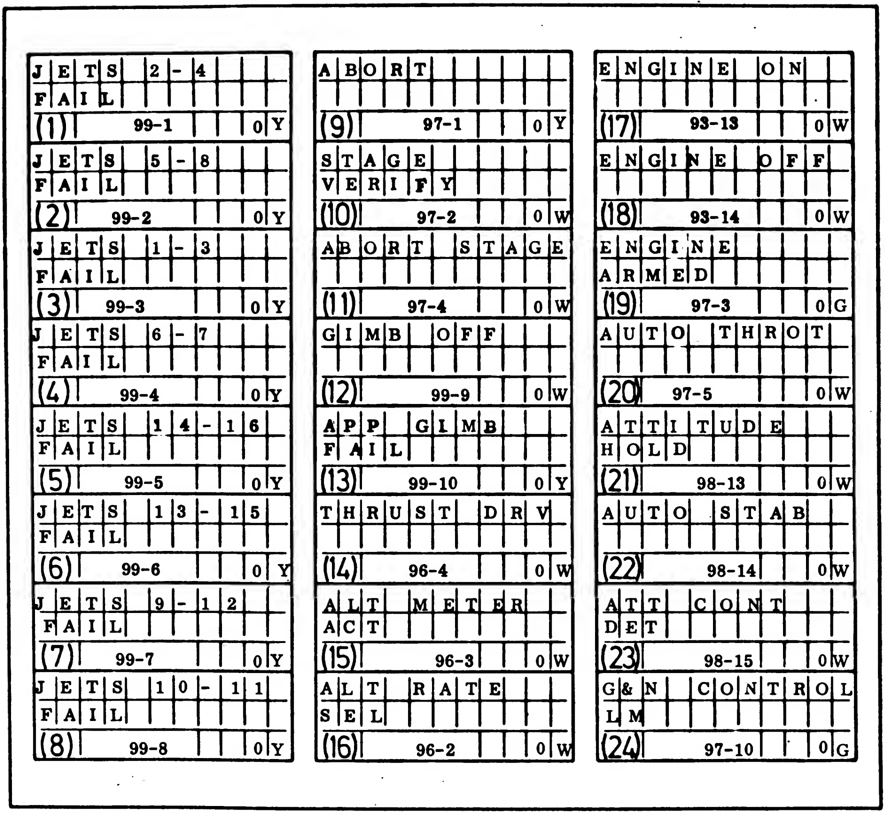
EVENT INDICATOR DISPLAY
FIGURE 3D



* Not applicable LTA8-M

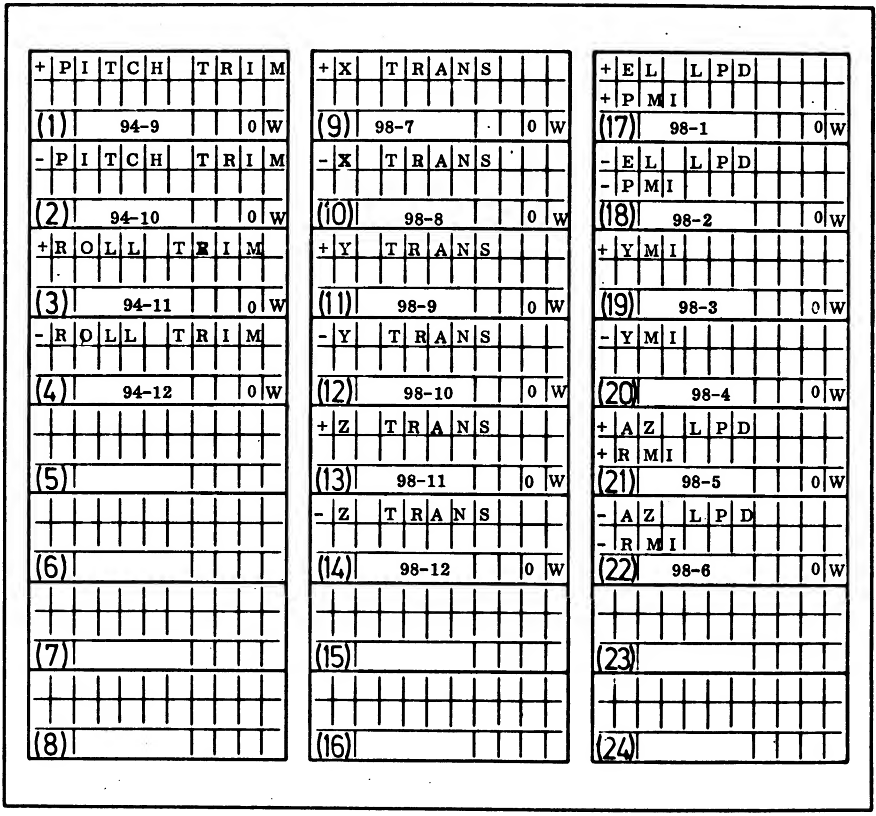
EVENT INDICATOR DISPLAY

FIGURE 3E


JETS 2-4 FAIL (1) 99-1 0 Y
JETS 5-8 FAIL (2) 99-2 0 Y
JETS 1-3 FAIL (3) 99-3 0 Y
JETS 6-7 FAIL (4) 99-4 0 Y
JETS 14-16 FAIL (5) 99-5 0 Y
JETS 13-15 FAIL (6) 99-6 0 Y
JETS 9-12 FAIL (7) 99-7 0 Y
JETS 10-11 FAIL (8) 99-8 0 Y
ABORT (9) 97-1 0 Y
STAGE VERIFY (10) 97-2 0 W
ABORT STAGE (11) 97-4 0 W
GIMB OFF (12) 99-9 0 W
APP GIMB FAIL (13) 99-10 0 Y
THRUST DRV (14) 96-4 0 W
ALT METER ACT (15) 96-3 0 W
ALT RATE SEL (16) 96-2 0 W
ENGINE ON (17) 93-13 0 W
ENGINE OFF (18) 93-14 0 W
ENGINE ARMED (19) 97-3 0 G
AUTO THROT (20) 97-5 0 W
ATTITUDE HOLD (21) 98-13 0 W
AUTO STAB (22) 98-14 0 W
ATT CONT DET (23) 98-15 0 W
G&N CONTROL LM (24) 97-10 0 G

EVENT INDICATOR DISPLAY

FIGURE 3F



EVENT INDICATOR DISPLAY

FIGURE 3G

3.7 **EVENT RECORDER SIGNAL ARRANGEMENT.** The signals recorded on the 32 channel Event Recorder, Panel/Module Number 004A2A2 shall be arranged as specified in Table VI.

TABLE VI

EVENT RECORDER SIGNAL ARRANGEMENT

LM	TYPE	SIGNAL ARRANGEMENT FIGURE 4
1	I	A
2	I	A
3	I	A
4	I	A
LTA8--M	I	B
1-K	II	C
2-K	II	C
3-G	II	C
4-G	II	C
LTA8-M	II	C

3.7.1 EVENT RECORDER DISPLAY (TYPE II ONLY). The following displays shall be allocated to recorders by the testing activity. The recorder and channel location shall be determined by the user.

MEASUREMENT	MEAS NO./ WORD-BIT	LINK
JETS 2-4 FAIL	99-1	
JETS 5-8 FAIL	99-2	
JETS 1-3 FAIL	99-3	
JETS 6-7 FAIL	99-4	
JETS 14-16 FAIL	99-5	
JETS 13-15 FAIL	99-6	
JETS 9-12 FAIL	99-7	
JETS 10-11 FAIL	99-8	
ABORT	97-1	
STAGE VERIF	97-2	
ABORT STAGE	97-4	
GIMB OFF	99-9	
APP GIMB FAIL	99-10	
THRUST DRV	96-4	
ALT METER SEL	96-3	
ALT RATE SEL	96-2	
ENGINE ON	93-13	
ENGINE OFF	93-14	
ENGINE ARMED	97-3	
AUTO THROT	97-5	
ATT HOLD	98-13	
AUTO STAB	98-14	
ATT CTRL DET	98-15	
G&N CONT LM	97-10	
CDU CONTROL	94-8	
DSP INRTL DATA	97-6	
C&WE MASTER ALM	GL4069	4
+PITCH TRIM	94-9	
-PITCH TRIM	94-10	
+ROLL TRIM	94-11	
-ROLL TRIM	94-12	
+X TRANS	98-7	
-X TRANS	98-8	
+Y TRANS	98-9	
-Y TRANS	98-10	
+Z TRANS	98-11	
-Z TRANS	98-12	
+EL LPD/+PMI	98-1	
-EL LPD/-PMI	98-2	
+AZ LPD/+RMI	98-5	
AZ LPD/-RMI	98-6	
+YMI	98-3	
-YMI	98-4	
RR ANT MODE	7-12	
RR ANT REMODE	7-14	
RR ANT REPOSITION	7-11	
RR DATA GOOD	100-4	
RR RANGE LO-SC	100-3	
LR VEL DATA GOOD	100-8	
LR ALT DATA GOOD	100-5	
LR ALT LO SCALE	100-9	
HORIZ VEL	94-3	
LR POS 1	100-6	
LR POS 2	100-7	
LR POS 2 CMD	94-13	
BLOWER CURR	GG 2303	4
HEATER CURR	GG 2302	4
IMU STBY NOISE PK	NG 1512	4
IMU OPER NOISE PK	NG 1502	4
4VDC CDU NOISE PK	NG 1072	4
LGC OPER NOISE PK	NG 1522	4
4VDC LGC NOISE PK	NG 1032	4
14VDC LGC NOISE PK	NG 1022	4
RR AUTO ANG TRK	GN 7615	4
P/ON MOD SW LGC	GN 7637	4
ISS WARNING	GG 9002	5
PNGS CAUTION	GG 9003	5
COARSE ALIGN	94-4	

NOTE: Link 4 signals not applicable to LTA8-M.

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			TIMING
2	GG 1523	5	+28 VDC LGC OPER GG 1523
3	GG 1513	5	+28 VDC IMU STBY GG 1513
4	GL 0801 *		1024 TIMING PCM GL 0801
5	NG 1522	4	+28 VDC LGC NOISE PK NG 1522
6	NG 1022	4	+14 VDC LGC NOISE PK NG 1022
7	NG 1032	4	+4 VDC LGC NOISE PK NG 1032
8	NG 1512	4	+28 VDC IMU STBY NOISE NG 1512
9	NG 1502	4	+28 VDC IMU OP NOISE PK NG 1502
10	NG 1072	4	+4 VDC CDU NOISE PK NG 1072
11	GG 2302	4	IMU HEATER CUR GG 2302
12	GG 2303	4	IMU BLOWER CUR GG 2303
13	GG 9006	4	IMU TEMP OUT OF LIMITS GG 9006
14	GG 9001	5	LGC WARNING GG 9001
15	GG 9002	5	ISS WARNING GG 9002
16	GG 9003	5	PNGS CAUTION GG 9003
17	GL 4069 *	4	C+WE MASTER ALARM GL 4069
18			
19			
20			
21			
22	GN 7557 *	5	LR VEL DATA NO GOOD GN 7557
23	GN 7584 *	4	LR MODE CONTROL GN 7684
24	GN 7533 *	4	LR LGC ANT 1 POS CMD GN 7533
25	GN 7576 *	4	LR ANT POS NO. 1 GN 7576
26	GN 7577 *	4	LR ANT POS NO. 2 GN 7577
27	GN 7521 *	5	LR RANGE DATA NO GOOD GN 7521
28	GN 7615 *	4	RR AUTO ANG TRK EN GN 7615
29	GN 7621 *	5	RR NO TRACK GN 7621
30	GN 7636 *	4	RR LO SCALE FACTOR GN 7636
31	GN 7637 *	4	RR PWR ON MODE SW IN LGC GN 7637
32			TIMING
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

* These measurements are not controlled by this specification but are included for reference only.

EVENT RECORDER SIGNAL ARRANGEMENT

FIGURE 4A

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			TIMING
2	GG 1523	5	+28 VDC LGC OPER GG 1523
3	GG 1513	5	+28 VDC IMU STBY GG 1513
4			
5			
6			
7			
8			
9			
10			
11	GG 2302		IMU HEATER CUR GG 2302
12	GG 2303		IMU BLOWER CUR GG 2303
13			
14	GG 9001	5	LGC WARNING GG 9001
15	GG 9002	5	ISS WARNING GG 9002
16	GG 9003	5	PGNS CAUTION GG 9003
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			TIMING
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

EVENT RECORDER SIGNAL ARRANGEMENT

FIGURE 4B

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	95-11		LGC STANDBY
2	GG1523	5	+28 VDC LGC OPER GG1523
3	GG1513	5	+28 VDC IMU STBY GG1513
4	97-9		IMU OPERATE
5	97-14		ISS TURNON REQUEST
6	100-2		RR ON/AUTO
7	7-15		CONT DESIG
8	97-7		RR CDU FAIL
9	94-2		RR ERR CTR ENABLE
10	94-14		RR LOCKON ENABLE
11	94-5		ZERO ICDU
12	90-4		NO ATT
13	94-6		IMU ERR CTR ENABLE
14	97-11		IMU CAGE
15	90-6		GIMBAL LOCK
16	93-4		TEMP CAUTION
17	93-7		OPERATOR ERROR
18	93-5		KEY RELEASE
19	93-3		UPLINK ACTIVITY
20	77-1		UPLOCK
21	90-9		PROG
22	97-13		IMU FAIL
23	40-4		IGN IMU FAIL
24	97-12		ICDU FAIL
25	40-3		IGN ICDU FAIL
26	100-3		PIPA FAIL
27	40-1		IGN PIPA FAIL
28	100-15		OSC ALARM
29	GG9001	5	LGC WARNING GG9001
30	90-8		TRACKER
31	GG9002	5	ISS WARNING
32			TIMING
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL ARRANGEMENT

EVENT RECORDER SIGNAL ARRANGEMENT

FIGURE 4C

3.8 **ANALOG RECORDER SIGNAL ARRANGEMENT.** The signals recorded on the Analog Recorder shall be arranged as specified in Table VII.

TABLE VII

ANALOG RECORDER SIGNAL ARRANGEMENT

LM	CONSOLE/PANEL		
	004A1		004A3
	Analog Module		Analog Module
	A2	A3	A2
1	Fig. 5A	Fig. 5B	Fig. 5C
2	Fig. 5A	Fig. 5B	Fig. 5C
3	Fig. 5A	Fig. 5B	Fig. 5C
4 [illegible]	Fig. 5A	Fig. 5B	Fig. 5C
LTA8-M	Fig. 5A	Fig. 5E	Fig. 5D

1	2	3
IG SERVO ERR IN PH GG 2107	IG TORQUE MTR CUR GG 2110	MG SERVO ERR IN PH GG 2137
Measurement No. GG 2107 Link No. 5	Measurement No. GG 2110** Link No. 5	Measurement No. GG 2137 Link No. 5

4	5	6
MG TORQUE MTR CUR GG 2140**	OG SERVO ERR IN PH GG 2167	OG TORQUE MTR CUR GG 2170**
Measurement No. GG 2140 Link No. 5	Measurement No. GG 2167 Link No. 5	Measurement No. GG 2170 Link No. 5

7	8
PIPA TEMP GG 2300	IRIG TEMP GG 2301*
Measurement No. GG 2300 Link No. 5	Measurement No. GG 2301 Link No. 5

*Not applicable LM4
**Use link 4 for LM4

8 CHANNEL ANALOG RECORDER SIGNAL ARRANGEMENT A

FIGURE 5A

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 2220	4	IG CDU FINE ERROR GG 2220
1	2	GG 2001	5	X PIP SG OUT IN PH GG 2001
1	3	GG 1020	4	+ 14V LGC SUP GG1020
1	4	GG 3312	4	RR SHAFT CDU COARSE ER GG 3312
2	1	GG 2250	4	MG CDU FINE ERROR GG 2250
2	2	NG 1521	4	+28 VDC LGC OPR NOISE NG 1521
2	3	GG 1030	4	+4V LGC SUP GG 1030
2	4	GG 3322	4	RR TRUN CDU COARSE ER GG 3322
3	1	GG 2280	4	OG CDU FINE ERROR GG 2280
3	2	GG 2021	5	Y PIP SG OUT IN PH GG 2021
3	3	GG 1070	4	+4 VDC CDU PWR SUP GG 1070
3	4	GG 3311	4	RR SHAFT CDU FINE ER GG 3311
4	1	GG 2219	5	PITCH ATT ER DAC OUT GG 2219
4	2	NG 1501	4	+28 VDC IMU OPR NOISE NG 1501
4	3	GG 1201	5	IMU 28V 1% 800 CPS GG 1201
4	4	GG 3321	4	RR TRUN CDU FINE ER GG 3321
5	1	GG 2249	5	YAW ATT ER DAC OUT GG 2249
5	2	GG 2041	5	Z PIP SG OUT IN PH GG 2041
5	3	GG 1202	4	IMU .8 KC 5% -90 DEG GG 1202
5	4	GG 3324	5	RR TRUN IX RES OUT SIN GG 3324
6	1	GG 2279	5	ROLL ATT ER DAC OUT GG 2279
6	2	NG 1511	4	+28 VDC IMU STB NOISE NG 1511
6	3	GG 1203	4	IMU .8 KC 5% 0 DEG GG 1203
6	4	GG 3325	5	RR TRUN IX RES OUT COS GG 3325
7	1	GG 1331	5	3.2 KC 28V SUP 1% GG 1331
7	2	GG 1040	5	+120 VDC PIPA SUP GG1040
7	3	GG 1510	4	+28V IMU STBY GG 1510
7	4	GG 3304	5	RR SHAFT IX OUT SIN GG 3304
8	1	NG 1342*		HIGH RATE MEASUREMENTS
8	2	GG 1500	4	+28V IMU OPER GG 1500
8	3	GG 1520	4	+28V LGC OPER GG 1520
8	4	GG 3305	5	RR SHAFT IX OUT COS GG 3305
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

*NG 1342 is a dummy measurement number depicting a high rate assignment.

ANALOG RECORDER SIGNAL ARRANGEMENT B

FIGURE 5B

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 2112	5	IG IX RSVR OUT SIN GG 2112
1	2	GG 2166	4	OG SERVO ERROR TOTAL GG 2166
1	3	NG 1501	4	+28V IMU OPER NOISE NG 1501
1	4	GN 7567 *	4	GAIN STATE 01 GN 7567
2	1	GG 2113	5	IG IX RSVR OUT COS GG 2113
2	2	GG 2281	4	OG CDU COARSE ERROR GG 2281
2	3	NG 1521	4	+28V LGC OPER NOISE NG 1521
2	4	GN 7568 *	4	GAIN STATE 02 GN 7568
3	1	GG 2142	5	MG IX RSVR OUT SIN GG 2142
3	2	GG 2106	4	IG SERVO ERROR TOTAL GG 2106
3	3	GG 2181**	5	OG IX OUT SIN 11 DEG GG 2181
3	4	GN 7569 *	4	GAIN STATE 03 GN 7569
4	1	GG 2143	5	MG IX RSVR OUT COS GG 2143
4	2	GG 2221	4	IG CDU COARSE ERR GG 2221
4	3	GG 6020***	5	PIP CAL MOD TEMP GG 6020
4	4	GN 7570 *	4	GAIN STATE 04 GN 7570
5	1	GG 2172	5	OG IX RSVR OUT SIN GG 2172
5	2	GG 2136	4	MG SERVO ERROR TOTAL GG 2136
5	3	GG 2121**	5	IG IX OUT SIN 11 DEG GG 2121
5	4	GN 7647 *	4	ATM OUT SHAFT GN 7647
6	1	GG 2173	5	OG IX RSVR OUT COS GG 2173
6	2	GG 2251	4	MG CDU COARSE ERR GG 2251
6	3	GG 6021	4	PSA TEMP GG 6021
6	4	GN 7645 *	4	ATM OUT TRUN GN 7645
7	1	GG 1100	4	-28 VDC SUPPLY GG 1100
7	2	GN 7655 *	4	AC PWR 1 GN 7655
7	3	GG 2151**	5	MG IX OUT SIN 11 DEG GG 2151
7	4	GN 7563 *	5	LR ANT TEMP GN 7563
8	1	GG 1110	5	2.5 VDC TM BIAS 1 GG 1110
8	2	GN 7656 *	4	AC PWR 2 GN 7656
8	3	GG 4300	4	LGC TEMP GG 4300
8	4	GN 7723 *	5	RR ANT TEMP GN 7723
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

* These measurements are not controlled by this specification but are included for reference only.
** Not applicable LM 4
*** Use link 4 for LM4

ANALOG RECORDER SIGNAL ARRANGEMENT C

FIGURE 5C

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 3324	5	RR TRUN 1X RES OUT SIN GG 3324
1	2	GG 2001	5	X PIP SG OUT IN PH GG 2001
1	3	GG 2112	5	IG 1X RSVR OUT SIN GG 2112
1	4	GG 4300		LGC TEMP GG 4300
2	1	GG 3325	5	RR TRUN 1X RES OUT COS GG 3325
2	2	GG 2021	5	Y PIP SG OUT IN PH GG 2021
2	3	GG 2113	5	IG 1X RSVR OUT COS GG 2113
2	4	GG 6021		PSA TEMP GG 6021
3	1			
3	2	GG 2041	5	Z PIP SG OUT IN PH GG 2041
3	3			
3	4	GG 8102		IMU PAD TEMP. AVE GG 8102
4	1	GG 2219	5	PITCH ATT ER DAC OUT GG 2219
4	2	GG 2181	5	OG 1X OUT SIN 11 DEG GG 2181
4	3	GG 1201	5	IMU 28V 1% 800 CPS GG 1201
4	4	GG 8103		IMU COOLANT INLET GG 8103
5	1	GG 2249	5	YAW ATT ER DAC OUT GG 2249
5	2	GG 2121	5	IG 1X OUT SIN 11 DEG GG 2121
5	3	GG 2142	5	MG 1X RSVR OUT SIN GG 2142
5	4	GG 8116	5	AOT EXT. VIEWING LENS GG 8116
6	1	GG 2279	5	ROLL ATT ER DAC OUT GG 2279
6	2	GG 2151	5	MG 1X OUT SIN 11 DEG GG 2151
6	3	GG 2143	5	MG 1X RSVR OUT COS GG 2143
6	4	GG 8117	5	AOT EXT PRESS SEAL GG 8117
7	1	GG 1331	5	3.2KC 28V SUP 1% GG 1331
7	2	GG 1040	5	+120 VDC PIPA SUP GG 1040
7	3	GG 2172	5	OG 1X RSVR OUT SIN GG 2172
7	4	GG 3304	5	RR SHAFT 1X OUT SIN GG 3304
8	1	GG 6020	5	PIP CAL MOD TEMP GG 6020
8	2	GG 1110	5	2.5 VDC TM BIAS 1 GG 1110
8	3	GG 2173	5	OG 1X RSVR OUT COS GG 2173
8	4	GG 3305	5	RR SHAFT 1X OUT COS GG 3305
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

ANALOG RECORDER SIGNAL ARRANGEMENT D

FIGURE 5D

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 8104		PTA HDR (PIPA CAL MOD) GG 8104
1	2	GG 8108		LGC LOC 2 GG 8108
1	3	GG 8114		CDU TRAY X FRONT LEFT GG 8114
1	4			
2	1	GG 8107		LGC LOC 1 GG 8107
2	2	GG 8105		PTA HDR (PULSE TORQUE SUP) GG 8105
2	3			
2	4			
3	1	GG 8110		PSA HDR (800 C 5% PH -A SUP) GG 8110
3	2			
3	3			
3	4			
4	1	GG 8113		CDU TRAY X (4 VDC SUP) GG 8113
4	2	GG 8112		PSA HDR (GIMBAL SERVO AMP) GG 8112
4	3			
4	4			
5	1	GG 8106		PTA HDR (BINARY CUR. SW) GG 8106
5	2			
5	3			
5	4			
6	1	GG 8109		LGC LOC 3
6	2			
6	3			
6	4			
7	1	GG 8111		PSA HDR (800 C 5% PH-B SUP) GG 8111
7	2			
7	3			
7	4			
8	1	GG 8115		CDU TRAY X FRONT RIGHT GG 8115
8	2			
8	3			
8	4			
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

ANALOG RECORDER ARRANGEMENT E

FIGURE 5E

3.9 R-START SIGNAL ARRANGEMENT. The R-START signal arrangement for each LM shall be as specified in Table VIII.

TABLE VIII

R-START SIGNAL

ARRANGEMENT

LM	CONSOLE/PANEL	
	004A2	004A4
	Module A06	Module A05
1	Figure 6B	Figure 6A
2	Figure 6B	Figure 6A
3	Figure 6B	Figure 6A
4	Figure 6B	Figure 6A
LTA8-M		Figure 6A

4A4A05

R-START 144				R-START 145			
			CRT ERROR RESET DG 0000	LGC DISPLAY PROGRAM DSKY G&N 622A or 622-200 DG 0001		LGC* DISPLAY RECORD G&N 624B or 624-200 DG0008	
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START 146				R-START 147 *			
K-START DUMP DG 0004	K-START VERIFY DG 0003	K-START LOAD- VERIFY DG 0002		PIPA REF SELECT DG 2501	X PIPA SELECT DG 2502	Y PIPA SELECT DG 2503	Z PIPA SELECT DG 2504
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

*Not applicable LTA8-M

R-START SIGNAL ARRANGEMENT A

FIGURE 6A

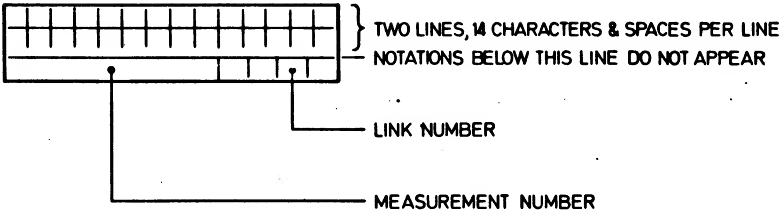
R-START 152*				R-START 153			
(D)	LGC TIME TRANS. G&N 603 DG 0007 (C)	LGC TIME CORR G&N 602 DG 0006 (B)	LGC CLOCK INITIAL G&N 601 DG 0005 (A)	(D)	(C)	(B)	(A)

R-START 154				R-START 155			
4 VDC SUPPLY LO WG 0023 (D)	4 VDC SUPPLY HI JG 0023 (C)	14 VDC SUPPLY LO WG 0022 (B)	14 VDC SUPPLY HI JG 0022 (A)	IG STEP INPUT JG 2505 (D)	MG STEP INPUT JG 2506 (C)	OG STEP INPUT JG 2507 (B)	LGC MARGIN TEST ENABLE JG 0021 (A)

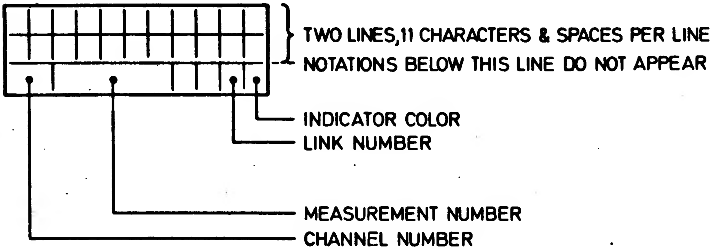
*Not applicable at GAEC for LM3 and all subsequent LM vehicles.

R-START SIGNAL ARRANGEMENT B

FIGURE 6B


TWO LINES, 14 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
LINK NUMBER
MEASUREMENT NUMBER

7 A. - METER IDENTIFICATION INSERT


TWO LINES, 11 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
INDICATOR COLOR
LINK NUMBER
MEASUREMENT NUMBER
CHANNEL NUMBER

7 B. - EVENT INDICATOR DISPLAY FORMAT

FIGURE 7

3.10 C-START. - **The C-START (C-156) arrangement for each LM shall be as specified in Table IX.**

TABLE IX

C-START ENTRY FORMAT

SUB-PROGRAM	C-START ENTRY
G&N 631	3100000XXX
*G&N 641	20XX000000
**G&N 601	--XXXXXXXX
(See NAA MA0201-0499, U0018) 4V Voltage Margin	±XXX001114
(See NAA MA0201-0499, U0018) 14V Voltage Margin	±XXX001124

* Not applicable to LTA8-M.

** Not applicable to LTA8-M and LM3 and all subsequent LM vehicles.

4. QUALITY ASSURANCE PROVISIONS

4.1 INSPECTION. The requirements specified in Section 3 shall be verified by visual inspection.

5. PREPARATION FOR DELIVERY. - This section is not applicable to this specification.

6. NOTES.

6.1 VARIATIONS TO SIGNAL ARRANGEMENT. Signal arrangements within a display module or assembly may be varied, but the signals shall be retained by the original module or assembly specified. The signal arrangement for the CRT display (3.4) shall be restricted to variations within the half page specified.

6.2 SPACECRAFT LOCATION. The letter following the LM vehicle number indicates the location of the vehicle. Locations are as follows:

	Applicable at
-G	Grumman Aircraft(GAEC)
-K	KSC
-M	MSC
No letter	Applicable at all locations

6.3 NOMENCLATURE VARIANCE. Nomenclature may be varied by the user in Sections 3.5 thru 3.8, however, the measurement number must always be a portion of the nomenclature.

APOLLO G&N Specification
ND1002322 REV —
Original Issue Date:
Release Authority: TDRR 31355
Class A Release
CODE IDENT NO. 99974

G&N PROGRAMMING REQUIREMENTS
(DISPLAYS & CONTROLS)
FOR
ACCEPTANCE CHECKOUT EQUIPMENT
(LM)

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
					NASA

This specification consists of page 1 to 33 inclusive.

APPROVALS	NASA/MSC		AC

1. SCOPE

1.1 PURPOSE. This specification establishes the G&N programming requirements for signal arrangements displays, and limits during post-installation checkout of a Lunar Module (LM) using Acceptance Checkout Equipment (ACE). (See 6.1)

2. APPLICABLE DOCUMENTS

2.1 EFFECTIVE ISSUES. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, Military Standards and Specifications shall be that issue in effect on the date of request for proposal or invitation to bid.

SPECIFICATIONS

APOLLO G&N

ND1002319	ACE-S/C Computer Subprogram Specification for APOLLO CM and LM G&N Testing

(Copies of specifications, standards, drawings, bulletins, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 CONFLICTING REQUIREMENTS. In the event of a conflict between requirements, the following order of precedence shall apply.

a. The contract.
b. This specification.
c. Documents listed in this specification.

3. REQUIREMENTS

3.1 G&N LM SUBPROGRAMS. The subprograms contained in Specification ND1002319 shall be used for the applicable LM configuration as specified in Table I.

TABLE I

SUBPROGRAMS

LM	SUBPROGRAMS	
	AC ELECTRONICS Identification Number	ASPO Identification Number
2	G&N 601	MIT-U005-0
	602	↑ U006-0
	603	U007-0
	621	D007-0
	622	D008-0
	624	D009-0
	631	C003-0
	632	U009-0
	641	C004-0
	652	D010-0
	671	↓ D011-0
	681	MIT-U008-0

3.2 SIGNAL BLINK LIMITS. The following signal blink limits shall apply to all G&N LM.

a. The following signals shall have blink limits equal to tolerances specified in the applicable LM Operational Checkout Procedure.

GG 1020
GG 1030
GG 1040
GG 1070
GG 1100
GG 1110
GG 1111
GG 1201
GG 1202
GG 1203
GG 1331
NG 1336
GG 1500
GG 1510
GG 1520

b. The following signals shall have blink limits of ±4095:

NG 1021
NG 1031
NG 1071
NG 1501
NG 1511
NG 1521
GG 2001
GG 2021
GG 2041
GG 2106
GG 2107
GG 2110
GG 2121
GG 2136
GG 2137
CG 2138
GG 2140
GG 2147
GG 2151
GC 2166
CG 2167
CG 2170
CG 2181
GG 2219
GG 2220
CG 2221
GG 2249
GG 2250
GG 2251
GG 2279
GG 2280
GG 2281
GG 2300
GG 2301
GG 3304
GG 3305
GG 3324
GG 3325
GG 3311
GG 3312
GG 3321
GG 3322
GG 4300
GG 6020
GG 6021

3.3 HIGH RATE MEASUREMENTS. The C START Panel shall program the signals specified in Table II.

TABLE II

HIGH RATE MEASUREMENTS

SIGNAL PROGRAMMED MEAS NO.
GG 2106
2110
2136
2140
2166
2170
2220
2221
2250
2251
2280
2281
3311
3312
3321
3322
1020
1030
1070
1202
1203
1500
GG 1520

3.4 CRT DISPLAYS. The CRT screen on the CRT module shall display information for each LM in accordance with Table III.

TABLE III

LM/CRT DISPLAY

LM	CRT DISPLAY FORMAT FIGURE
1	
2	1A, 1B, 1C, 1D, 1E, 1F
3	

SCOPE SPACING CHART FOR PAGE DISPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
AA																																								
1																																								
2																																								
3																																								
4																																								
5																																								
6																																								
7																																								
8	1	1	1	1		F	Q		2	.	5	V		T	M		B	I	A	S												X	.	X	X		V	D	C	
9												N	O	I	S	E		M	E	A	S	U	R	E	M	E	N	T	S		V	R	M	S						
10	1	0	2	1		+	1	4		L	G	C				X	.	X	X		1	5	0	1		+	2	8		O	P					X	.	X	X	
11	1	0	3	1		+		4		L	G	C				X	.	X	X		1	5	1	1		+	2	8	S	T	B	Y				X	.	X	X	
12	1	0	7	1		+		4		C	D	U				X	.	X	X		1	5	2	1		+	2	8		L	G	C				X	.	X	X	
13		G	G				M	E	A	S							V	D	C			G	G				M	E	A	S						V	R	M	S	
14	1	0	2	0		+	1	4		L	G	C				X	X	.	X		1	2	0	1		I	M	U		1	%	0				X	X	.	X	
15	1	0	3	0		+		4		L	G	C				X	.	X	X		1	2	0	2		I	M	U		5	%	-				X	X	.	X	
16	1	0	4	0		1	2	0		P	I	P					X	X	X		1	2	0	3		I	M	U		5	%	0				X	X	.	X	
17	1	0	7	0		+		4		C	D	U				X	.	X	X		1	3	3	1		3	.	2	K	2	8	V				X	X	.	X	
18	1	1	0	0		-	2	8		S	U	P				X	X	.	X																					
19	1	5	0	0		+	2	8		O	P					X	X	.	X				G	G					T	E	M	P				D	E	G	F	
20	1	5	1	0		+	2	8	S	T	B	Y				X	X	.	X		2	3	0	0					P	I	P	A			X	X	X	.	X	
21	1	5	2	0		+	2	8		L	G	C				X	X	.	X		2	3	0	1					I	R	I	G			X	X	X	.	X	
22	1	1	1	0		T	M		B	I	A	S				X	.	X	X		4	3	0	0		L	G	C	T	E	M	P					X	X	X	
23		N	G			P	H		D	I	F						D	E	G		6	0	2	0		C	A	L		M	O	D					X	X	X	
24	1	3	3	6		3	.	2	/	L	G	C					X	X	X		6	0	2	1		I	M	U		5	%						X	X	X	
25																																								

NOTE: GG 2301 is Link 5

CRT DISPLAY

FORMAT A

FIGURE 1A

SCOPE SPACING CHART
FOR PAGE DiSPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
AA																																								
1	0	1			I	S	S		M	E	A	S						O	G	/	X					I	G	/	Y					M	G	/	Z			
2	0	2		C	D	U		A	N	G	L	E	S					X	X	X	.	X	X			X	X	X	.	X	X			X	X	X	.	X	X	
3	0	3		G	I	M	B		A	N	G	L	E	S				X	X	X						X	X	X				X	X	X			D	E	G	
4	0	4		S	E	R	V	O		E	R		Ø					X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
5	0	5		S	E	R	V	O		E	R		T	L				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
6	0	6		C	D	U		F	I	N	E		E	R				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
7	0	7		C	D	U		C	R	S			E	R				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
8	0	8		T	O	R		M	O	T		C	U	R				.	X	X	X					.	X	X	X			.	X	X	X		A	M	P	S
9	0	9		P	I	P		S	G		O	U	T	Ø				X	.	X	X					X	.	X	X			X	.	X	X		V	R	M	S
10																		R	O	L	L				P	I	T	C	H				Y	A	W					
11	1	1		D	A	C		A	T	T		E	R					X	X	.	X					X	X	.	X			X	X	.	X		D	E	G	
12	1	2		1	X		S	I	N		1	1	°					X	X	.	X					X	X	.	X			X	X	.	X		D	E	G	
13																																								
14																																								
15																																								
16																																								
17																																								
18																																								
19																																								
20																																								
21																																								
22																																								
23																																								
24																																								
25																																								

CRT DISPLAY

FORMAT B

FIGURE 1B

SCOPE SPACING CHART
FOR PAGE DISPLAY

AA																																								
1		R	R		S	H	A	F	T							V	R	M	S				R	R			T	R	U	N						V	R	M	S	
2	0	2		1	X		S	I	N							X	.	X	X		1	X		S	I	N										X	.	X	X	
3	0	3		1	X		C	O	S							X	.	X	X		1	X		C	O	S										X	.	X	X	
4		R	R		C	D	U		S	H	A	F	T			V	R	M	S				R	R		C	D	U		T	R	U	N			V	R	M	S	
5	0	5		F	I	N	E				E	R				X	.	X	X		F	I	N	E				E	R							X	.	X	X	
6	0	6		C	O	A	R	S	E		E	R				X	.	X	X		C	O	A	R	S	E		E	R							X	.	X	X	
7	0	7																																						
8	0	8		R	R		R	A	N	G	E											X	X	X	X	X	X	X	X	X	X	.	X	X	X		F	E	E	T
9	0	9		R	R		R	G	E		R	A	T	E								X	X	X	X	X	X	X	X	X	X	.	X	X	X		F	P	S	
10																																								
11																																								
12																																								
13	1	3		R	R		T	R	U	N				X	X	X	.	X	X		R	R		S	H	A	F	T				X	X	X	.	X	X	D	E	G
14	1	4		T	C	K	E	R		F	A	I	L				O	F	F		R	R		C	D	U		F	A	I	L						O	F	F	
15	1	5		R	R	D	A	T	A		F	A	I	L			O	F	F		I	G	N		R	R	C	D	U		F	A	I	L			O	F	F	
16	1	6		L	R		A	L	T		F	A	I	L			O	F	F		R	R		L	O	C	K	O	N		A	B	L				O	F	F	
17	1	7		L	R		V	E	L		F	A	I	L			O	F	F		R	R		O	N	/	A	U	T	O							O	F	F	
18	1	8		R	R		A	N	T		O	U	T				O	F	F		R	R		R	A	N	G	E		L	O	-	S	C			O	F	F	
19	1	9		R	R		A	N	T		M	O	D	E			O	F	F		R	R		D	A	T	A			G	O	O	D				O	F	F	
20	2	0		R	R		A	N	T		R	E	M	D			O	F	F		L	R		A	L	T		D		G	O	O	D				O	F	F	
21	2	1		C	O	N	T		D	E	S	I	G				O	F	F		L	R		P	O	S		1									O	F	F	
22	2	2		Z	E	R	O		R	R		C	D	U			O	F	F		L	R		P	O	S		2									O	F	F	
23	2	3		R	R		E	R		C	T	R					O	F	F		L	R		V	E	L		D		G	O	O	D				O	F	F	
24	2	4		L	R		P	O	S	2		C	M	D			O	F	F		L	R		A	L	T		L	O	-	S	C					O	F	F	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT C

FIGURE 1C

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1		L	M	P	C	M	D						X	X	X	X	X																					
2	0	2		I	D	W	D	1							X	X	X	X	X																					
3	E	N	G	I	N	E		O	N								O	F	F		+	X		T	R	A	N	S									O	F	F	
4	E	N	G	I	N	E		O	F	F							O	F	F		-	X		T	R	A	N	S									O	F	F	
5	+	P	I	T	C	H		T	R	I	M						O	F	F		+	Y		T	R	A	N	S									O	F	F	
6	-	P	I	T	C	H		T	R	I	M						O	F	F		-	Y		T	R	A	N	S									O	F	F	
7	+	R	O	L	L		T	R	I	M							O	F	F		+	Z		T	R	A	N	S									O	F	F	
8	-	R	O	L	L		T	R	I	M							O	F	F		-	Z		T	R	A	N	S									O	F	F	
9	T	H	R	U	S	T		D	R	V							O	F	F		A	T	T	I	T	U	D	E		H	O	L	D				O	F	F	
10	A	B	O	R	T												O	F	F		A	U	T	O		M	O	D	E								O	F	F	
11	S	T	A	G	E		V	E	R	I	F						O	F	F		A	T	T		C	O	N	T		D	E	T					O	F	F	
12	E	N	G	I	N	E		A	R	M	E	D					O	F	F		J	E	T	S		2	-	4		F	A	I	L				O	F	F	
13	A	B	O	R	T		S	T	A	G	E						O	F	F		J	E	T	S		5	-	8		F	A	I	L				O	F	F	
14	A	U	T	O		T	H	R	O	T							O	F	F		J	E	T	S		1	-	3		F	A	I	L				O	F	F	
15	G	&	N		C	T	L		L	E	M						O	F	F		J	E	T	S		6	-	7		F	A	I	L				O	F	F	
16	+	E	L		L	P	D	/	+	P	M	I					O	F	F		J	E	T	S		1	4	-	1	6		F	L				O	F	F	
17	-	E	L		L	P	D	/	-	P	M	I					O	F	F		J	E	T	S		1	3	-	1	5		F	L				O	F	F	
18	+	Y	M	I													O	F	F		J	E	T	S		9	-	1	2		F	A	I	L			O	F	F	
19	-	Y	M	I													O	F	F		J	E	T	S		1	0	-	1	1		F	L				O	F	F	
20	+	A	Z		L	P	D	/	+	R	M	I					O	F	F		P	I	T	C	H		G	I	M	B		O	F	F			O	F	F	
21	-	A	Z		L	P	D	/	-	R	M	I					O	F	F		R	O	L	L		G	I	M	B		O	F	F				O	F	F	
22																																								
23																																								
24																																								
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT D

FIGURE 1D

SCOPE SPACING CHART FOR PAGE DISPLAY

AA																																								
1	0	1		A	L	T		R	A	T	E				X	X	X	X	.	X		F	P	S																
2	0	2		A	L	T	S	A	V	E			D	P				X	X	X	X	X	X	X	.	X	X	X		F	T									
3	0	3		F	I	N	A	L	T				D	P				X	X	X	X	X	X	X	.	X	X	X		F	T									
4	0	4		F	O	R	V	E	L			X	X	X	.	X	X		F	P	S		L	A	T	V	E	L			X	X	X	.	X	X		F	P	S
5																																								
6	H	O	R	I	Z		V	E	L								O	F	F		A	L	T		M	E	T	E	R		A	C	T				O	F	F	
7	C	D	U		C	O	N	T	R	O	L						O	F	F		D	S	P		I	N	R	T	L		D	A	T	A			O	F	F	
8	A	L	T		R	A	T	E		S	E	L					O	F	F																					
9	0	9			L	R		A	L	T												X	X	X	X	X	X	X	X	X	.	X	X	X	X		F	P	S	
10	1	0			L	R		V	X													X	X	X	X	X	X	X	X	X	.	X	X	X	X		F	P	S	
11	1	1			L	R		V	Y													X	X	X	X	X	X	X	X	X	.	X	X	X	X		F	P	S	
12	1	2			L	R		V	Z													X	X	X	X	X	X	X	X	X	.	X	X	X	X		F	P	S	
13	T	E	M	P		C	A	U	T	I	O	N					O	F	F		I	M	U		F	A	I	L									O	F	F	
14	G	I	M	B	A	L		L	O	C	K						O	F	F		I	G	N		I	M	U		F	A	I	L					O	F	F	
15	N	O		A	T	T	I	T	U	D	E						O	F	F		I	M	U		O	P	E	R	A	T	E						O	F	F	
16	I	S	S		W	A	R	N	I	N	G						O	F	F		C	O	A	R	S	E		A	L	I	G	N					O	F	F	
17	L	G	C		W	A	R	N	I	N	G						O	F	F		Z	E	R	O		I	S	S		C	D	U					O	F	F	
18	O	S	C		A	L	A	R	M								O	F	F		I	S	S		E	R	R		C	T	R						O	F	F	
19	T	E	S	T		A	L	A	R	M	S						O	F	F		I	M	U		C	A	G	E									O	F	F	
20	A	B	L		L	G	C		S	T	B	Y					O	F	F		I	N	I	T	I	A	L	I	Z	E		I	S	S			O	F	F	
21	B	L	O	C	K		U	P	L	I	N	K					O	F	F		I	S	S		T	R	N	O	N		R	Q	S	T			O	F	F	
22	T	E	M	P		I	N		L	I	M						O	F	F		I	S	S		T	R	N	O	N		C	O	M	P			O	F	F	
23	P	I	P	A		F	A	I	L								O	F	F		I	S	S		C	D	U		F	A	I	L					O	F	F	
24	I	G	N		P	I	P		F	A	I	L					O	F	F		I	G	N		I	C	D	U		F	A	I	L				O	F	F	
25																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

CRT DISPLAY

FORMAT E

FIGURE 1E

SCOPE SPACING CHART FOR PAGE DISPLAY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
AA																																								
1		U	P	L	I	N	K		A	C	T		C	O	M	P	U	T	E	R		P	R	O	G	R	A	M		V	E	R	B			N	O	U	N	
2	K	S	E	Q									O	K											X	X					X	X					X	X		
3	K	E	Y		R	E	L	E	A	S	E						O	F	F										R	1			X	X	X	X	X			
4	U	P	L	O	C	K											O	F	F										R	2			X	X	X	X	X			
5	D	W	N	L	K		T	O	O		F	A	S	T			O	F	F										R	3			X	X	X	X	X			
6	U	P	L	N	K		T	O	O		F	A	S	T			O	F	F		O	P	E	R	A	T	O	R		E	R	R					O	F	F	
7	I	N	H	I	B	I	T		U	P	L	I	N	K			O	F	F		P	R	O	G	R	A	M			A	L	M					O	F	F	
8	S	Y	N	C		E	R	R	O	R			X	X							R	E	D	O	C	T	R						X	X	X	X	X			
9	W	O	R	D		E	R	R	O	R			X	X	X	X	X	X	X		F	A	I	L	R	E	G						X	X	X	X	X			
10	R	E	L			E	R	R	O	R			X								P	A	R		E	R	R	O	R				X							
11	V	E	R			E	R	R	O	R			X								K	E	Y		E	R	R	O	R				X	X						
12	L	G	C		T	I	M	E			X	X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X		S	E	C					
13	T	I	M	E		E	P	O	C	H		X	X	X		H	R	S		X	X		M	I	N		X	X	.	X	X	X		S	E	C				
14	T	I	M	E		E	R	R	O	R		X	X	X	X						Δ		T	I	M	E			X	X	X	.	X	X	X		S	E	C	
15	P	I	P	A		M	E	A	S			X	X	X							H	I		R	A	T	E		M	E	A	S		X	X	X	X	X	X	
16																		O	G							I	G							M	G					
17	1	7		C	D	U		A	N	G	L	E	S			X	X	X	.	X	X			X	X	X	.	X	X			X	X	X	.	X	X	D	E	G
18																																								
19	1	9		P	I	P	A	X							X	X	X	X	X																					
20	2	0		P	I	P	A	Y							X	X	X	X	X																					
21	2	1		P	I	P	A	Z							X	X	X	X	X																					
22	2	2		A	N	G	X	/	P	I	P	E			X	X	X	X	X		V	D	R	I	F	T	O			X	X	X	.	X	X		M	E	R	U
23	2	3		A	N	G	Y	/	P	I	P	N			X	X	X	X	X		S	D	R	I	F	T	I			X	X	X	.	X	X		M	E	R	U
24	2	4		A	N	G	Z								X	X	X	X	X		E	D	R	I	F	T	T			X	X	X	.	X	X		M	E	R	U
25																																								

CRT DISPLAY

FORMAT F

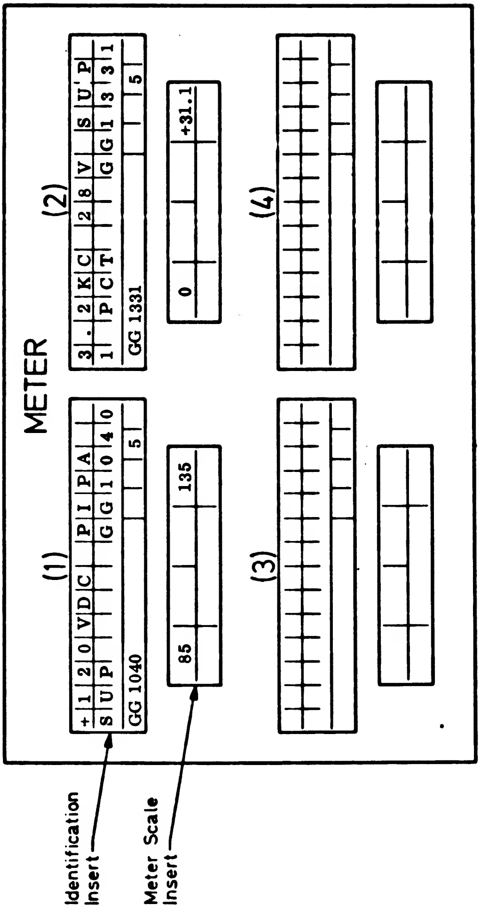
FIGURE 1F

3.5 METER DISPLAYS. The meter display format assignment for each LM shall be as specified in Table IV.

TABLE IV

METER DISPLAYS

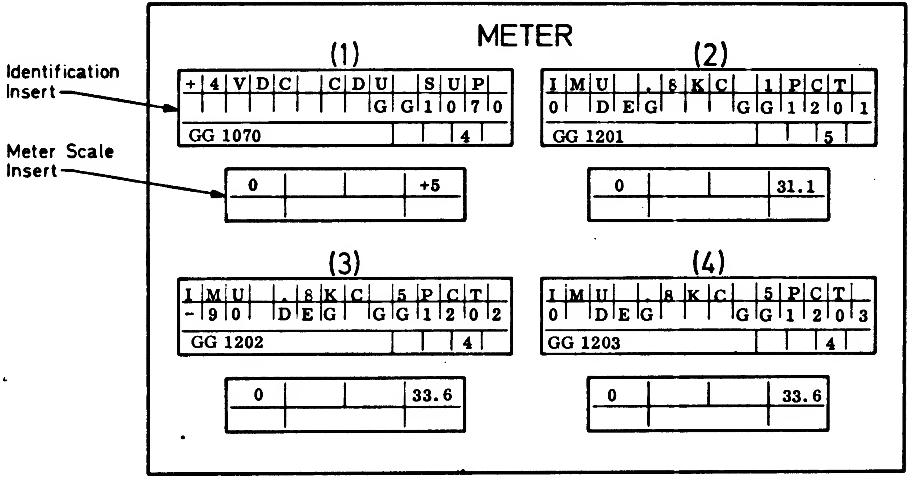
LM	Console Panel							
	004A2		004A3			014A1		
	Meter Module		Meter Module			Meter Module		
	A3 Figure	A4 Figure	A6 Fig.	A7 Fig.	A8 Fig.	A9 Fig.	A3 Figure	A4 Figure
2	2A	2B	2C	2D	2E	2F	2G	2H



*See Figure 7A

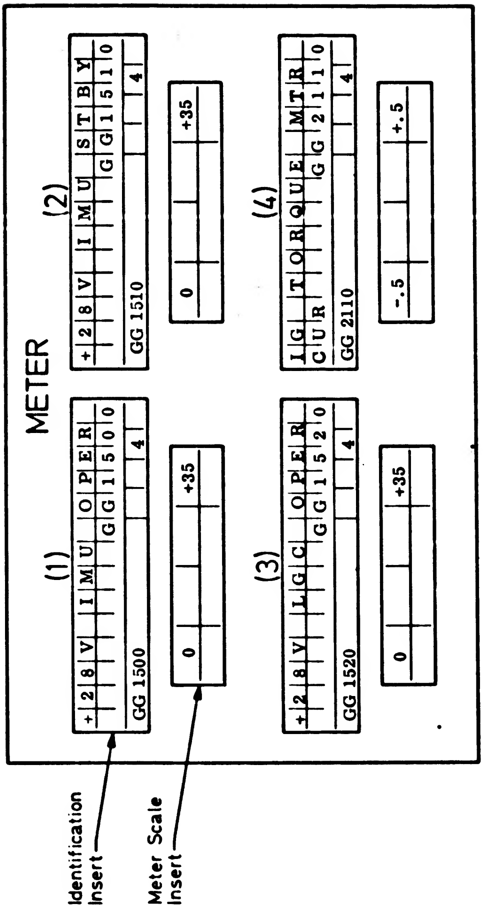
METER DISPLAY A

FIGURE 2A



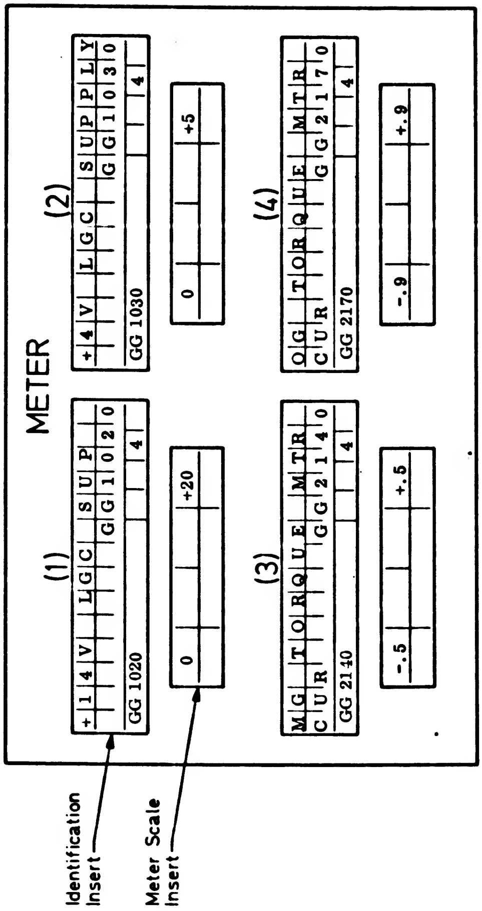
METER DISPLAY B

FIGURE 2B



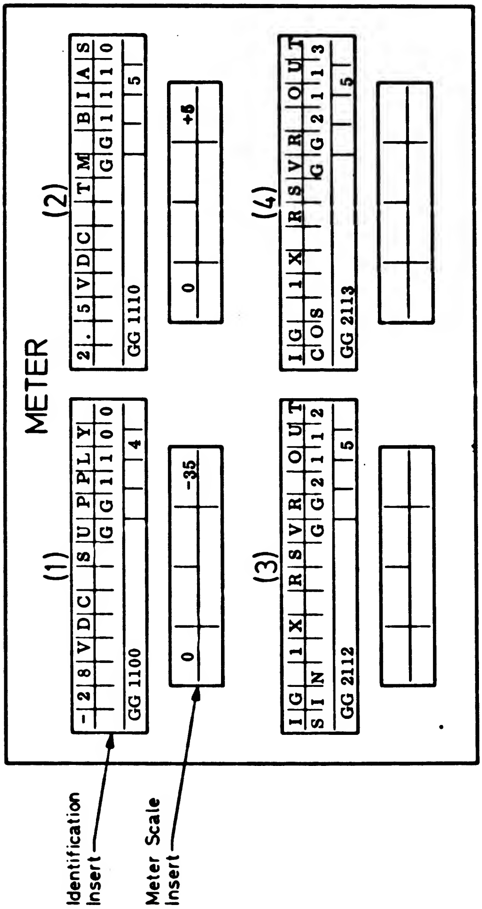
METER DISPLAY C

FIGURE 2C



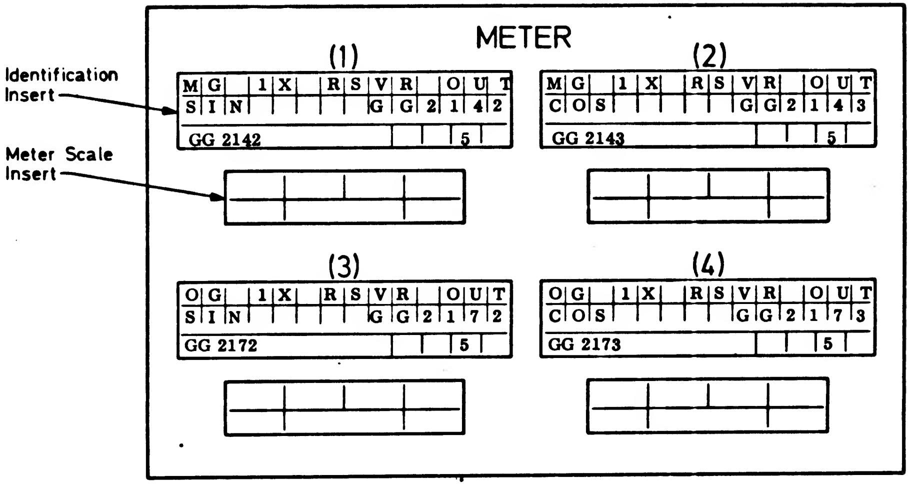
METER DISPLAY D

FIGURE 2D



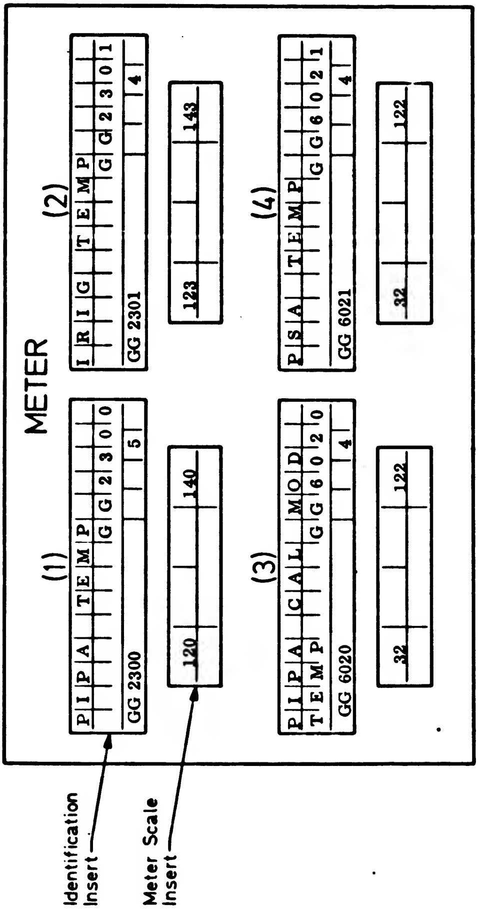
METER DISPLAY E

FIGURE 2E



METER DISPLAY F

FIGURE 2F



METER DISPLAY G

FIGURE 2G

3.6 EVENT INDICATOR DISPLAYS. The event indicator display format assignment for each LM shall be as specified in Table V.

TABLE V
EVENT INDICATOR
DISPLAYS

LM	CONSOLE/PANEL					
	004A3		014A1		004A4	
	Event	Module	Event	Module	Event	Module
	A4 Figure	A5 Figure	A1 Figure	A2 Figure		
2		3A	3B	3A		

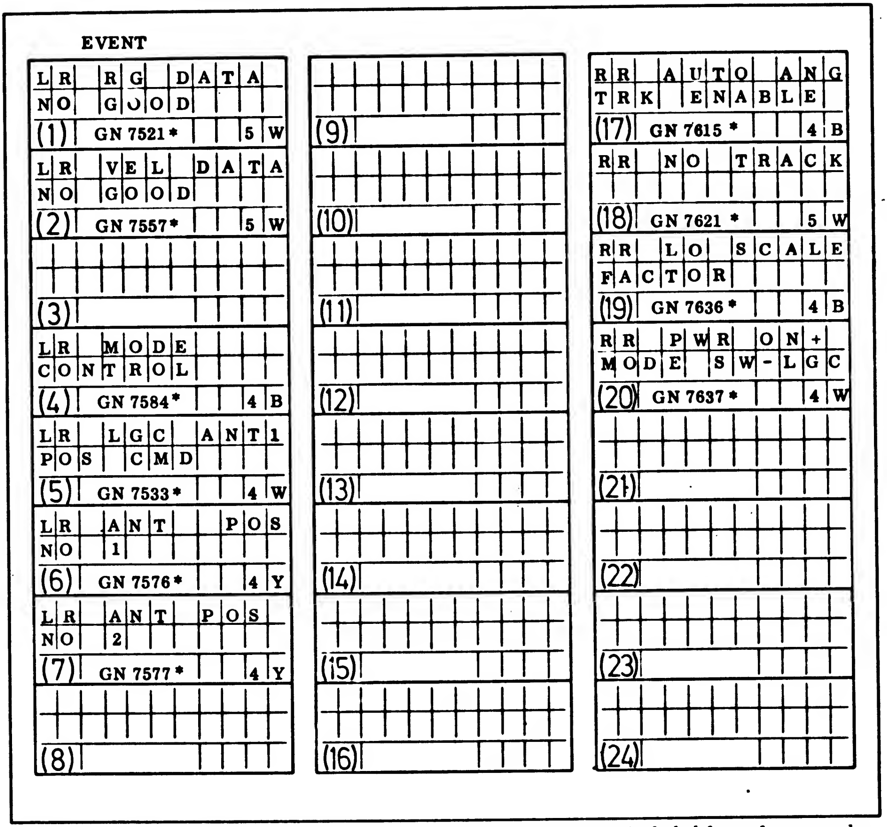
*EVENT INDICATORS

(1)	28V LGC	NOISE PEAKS	NG 1522	4	R
(2)	14V LGC	NOISE PEAKS	NG 1022	4	R
(3)	4V LGC	NOISE PEAKS	NG 1032	4	R
(4)					
(5)	28V IMU OP	NOISE PEAKS	NG 1502	4	R
(6)	28V IMU STB	NOISE PEAKS	NG 1512	4	R
(7)	4V CDU	NOISE PEAKS	NG 1072	4	R
(8)					
(9)	28V LGC	OPERATE	GG 1523	5	G
(10)	28V IMU	STBY	GG 1513	5	B
(11)	IMU HEATER	CURRENT OFF	GG 2302	4	W
(12)	IMU BLOWER	CURRENT OFF	GG 2303	4	W
(13)					
(14)					
(15)					
(16)					
(17)	LGC WARNING		GG 9001	5	Y
(18)	ISS WARNING		GG 9002	5	Y
(19)	PNG CAUTION		GG 9003	5	Y
(20)					
(21)					
(22)					
(23)					
(24)					

See Figure 7B

EVENT INDICATOR DISPLAY A

FIGURE 3A



*These measurements are not controlled by this specification but are included for reference only

EVENT INDICATOR DISPLAY B

FIGURE 3B

3.7 EVENT RECORDER SIGNAL ARRANGEMENT. The signals recorded on the 32 channel Event Recorder, Panel/Module Number 004A2A2 shall be arranged as specified in Table VI.

TABLE VI

EVENT RECORDER SIGNAL ARRANGEMENT

LM	SIGNAL ARRANGEMENT FIGURE
2	4A

CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1			
2	NG 1522	4	+28 VDC LGC NOISE PK
3	NG 1022	4	+14 VDC LGC NOISE PK
4	NG 1032	4	+4 VDC LGC NOISE PK
5			
6	NG 1502	4	+28 VDC IMU OP NOISE PK
7	NG 1512	4	+28 VDC IMU STBY NOISE
8	NG 1072	4	+4 VDC CDU NOISE PK
9			
10	GG 1523	5	+28 VDC LGC OPER
11	GG 1513	5	+28 VDC IMU STBY
12	GG 2302	4	IMU HEATER CUR
13	GG 2303	4	IMU BLOWER CUR
14			
15	GG 9001	5	LGC WARNING
16	GG 9002	5	ISS WARNING
17	GG 9003	5	PNGS CAUTION
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
CHANNEL	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

EVENT RECORDER SIGNAL ARRANGEMENT

FIGURE 4A

3.8 ANALOG RECORDER SIGNAL ARRANGEMENT. The signals recorded on the Analog Recorder shall be arranged as specified in Table VII.

TABLE VII

ANALOG RECORDER SIGNAL ARRANGEMENT

LM	CONSOLE/PANEL		
	004A1		004A3
	Analog Module		Analog Module
	A2	A3	A2
2	Fig. 5A	Fig. 5B	Fig. 5C

1	2 •	3
800/400 CPS REF VRMS GN 7686	800/400 CPS REF FREQ NN 00002	ATM OUT SHAFT GN 7647
Measurement No. GN 7686 * Link No.	Measurement No. NN 0002 * Link No.	Measurement No. GN 7647 * Link No. 4

4	5	6
ATM OUT TRUN GN 7645		
Measurement No. GN 7645 * Link No. 4	Measurement No. Link No.	Measurement No. Link No.

7	8
Measurement No. Link No.	Measurement No. Link No.

*These measurements are not controlled by this specification but are included for reference only

8 CHANNEL ANALOG RECORDER SIGNAL ARRANGEMENT A

FIGURE 5A

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1	GG 2110	5	IG TORQUE MOT CUR GG 2110
1	2	GG 2167	5	OG SERVO ERROR IN PH GG 2167
1	3	GG 2251	4	MG CDU COARSE ERROR GG 2251
1	4	GN 7563*	5	LR ANT TEMP GN 7563
2	1	GG 2221	4	IG CDU COARSE ERROR GG 2221
2	2	GG 2170	5	OG TORQUE MOT CUR GG 2170
2	3	GG 2137	5	MG SERVO ERROR IN PH GG 2137
2	4			
3	1	GG 2107	5	IG SERVO ERROR IN PH GG 2107
3	2	GG 2281	4	OG CDU COARSE ERROR GG 2281
3	3	GG 2140	5	MG TORQUE MOT CUR GG 2140
3	4	GN 7723*	5	RR ANT TEMP GN 7723
4	1	GG 2112	5	IG 1X RSVR OUT SIN GG 2112
4	2	GG 2280	4	OG CDU FINE ERROR GG 2280
4	3	GG 2143	5	MG 1X RSVR OUT COS GG 2143
4	4	GN 7654*		RF PWR OUT GN 7654
5	1	GG 2113	5	IG 1X RSVR OUT COS GG 2113
5	2	GG 2172	5	OG 1X RSVR OUT SIN GG 2172
5	3	GG 2250	4	MG CDU FINE ERROR GG 2250
5	4			
6	1	GG 2220	4	IG CDU FINE ERROR GG 2220
6	2	GG 2173	5	OG 1X RSVR OUT COS GG 2173
6	3	GG 2142	5	MG 1X RSVR OUT SIN GG 2142
6	4			
7	1	GG 1201	5	IMU 28V 1PCT 800 CPS GG 1201
7	2	GG 3304	5	RR SHAFT 1X OUT SIN GG 3304
7	3	GG 6020	4	PIP CAL MOD TEMP GG 6020
7	4	GN 7655*	4	AC PWR 1 GN 7655
8	1			
8	2	GG 3305	5	RR SHAFT 1X OUT COS GG3305
8	3	GG 6021	4	PSA TEMP GG 6021
8	4	GN 7656*	4	AC PWR 2 GN 7656
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

*These measurements are not controlled by this specification but are included for reference only

ANALOG RECORDER SIGNAL ARRANGEMENT A

FIGURE 5B

CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION
1	1			HIGH RATE
1	2			
1	3			
1	4			
2	1	GG 1030	4	+4 VDC LGC SUP GG 1030
2	2	GG 3311	4	RR SHAFT CDU FINE ER GG 3311
2	3	GG 2300	5	PIPA TEMP GG 2300
2	4			
3	1	GG 1020	4	+14 VDC LGC SUP GG 1020
3	2	GG 3321	4	RR TRUN CDU FINE ER GG 3321
3	3	GG 2301	5	IRIG TEMP GG 2301
3	4	GN 7597*		ALT TRANS TEST CPL OUT GG 7597
4	1	GG 1331	5	3 . 2KC 28V SUP GG 1331
4	2	GG 3324	5	RR TRUN 1X RES OUT-SIN GG 3324
4	3	GG 1520	4	+28 VDC LGC OPER GG 1520
4	4	GN 7598*		VEL TRANS TEST CPL OUT GN 7598
5	1	GG 2001	5	X PIP SG OUT IN PH GG 2001
5	2	GG 3325	5	RR TRUN 1X RES OUT-COS GG 3325
5	3	GG 4300	4	LGC TEMP GG 4300
5	4	GN 7567*	4	GAIN STATE 01 GN 7567
6	1	GG 2021	5	Y PIPA SG OUT IN PH GG 2021
6	2	GG 2219	5	PITCH ATT ERR DAC OUT GG 2219
6	3	GG 2181	5	OG 1X OUT SIN 11 DEG GG 2181
6	4	GN 7568*	4	GAIN STATE 02 GN 7568
7	1	GG 2041	5	Z PIPA SG OUT IN PH GG 2041
7	2	GG 2249	5	YAW ATT ERROR DAC OUT GG 2249
7	3	GG 2121	5	IG 1X OUT SIN 11 DEG GG 2121
7	4	GN 7569*	4	GAIN STATE 03 GN 7569
8	1	GG 1040	5	+120 VDC PIPA SUPPLY GG 1040
8	2	GG 2279	5	ROLL ATT ERROR DAC OUT GG 2279
8	3	GG 2151	5	MG 1X OUT SIN 11 DEG GG 2151
8	4	GN 7570*	4	GAIN STATE 04 GN 7570
CHANNEL / SWITCH NO.	SWITCH POSITION	MEASUREMENT NUMBER	LINK NUMBER	SIGNAL IDENTIFICATION

***These measurements are not controlled by this specification but are included for reference only**

. ANALOG RECORDER SIGNAL ARRANGEMENT B

FIGURE 5C

3.9 R-START SIGNAL ARRANGEMENT. The R-START signal arrangement for each LM shall be as specified in Table VIII.

TABLE VIII

R-START SIGNAL

ARRANGEMENT

LM	CONSOLE/PANEL	
	004A2	004A4
	Module A06	Module A05
2	Figure 6B	Figure 6A

4A4A05

R-START 144				R-START 145			
			CRT ERROR RESET	LGC DISPLAY PROGRAM			
			DG 0000	DG 0001			
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START 146				R-START 147			
K-START DUMP	K-START VERIFY	K-START LOAD- VERIFY		PIPA REF SELECT	X PIPA SELECT	Y PIPA SELECT	Z PIPA SELECT
DG 0004	DG 0003	DG 0002		DG 2501	DG 2502	DG 2503	DG 2504
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START SIGNAL ARRANGEMENT A

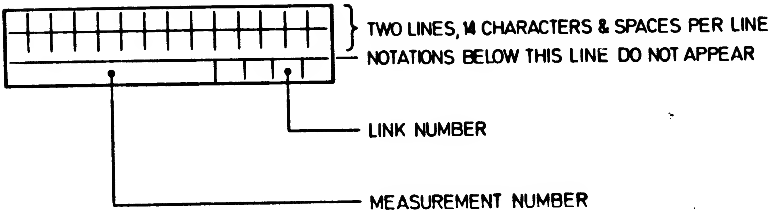
FIGURE 6A

R-START 152				R-START 153			
	LGC TIME TRANS-MISSION DG 0007	LGC TIME CORRECTION DG 0006	LGC CLOCK INITIALIZATION DG 0005				
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

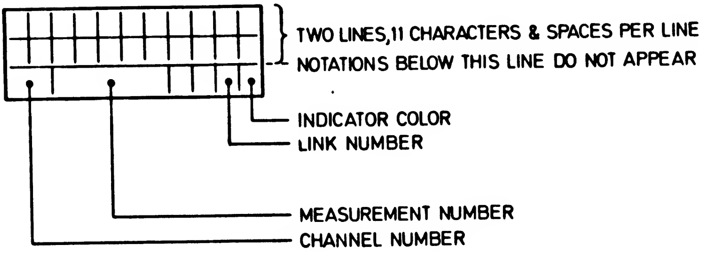
R-START 154				R-START 155			
4 VDC SUPPLY LO WG 0023	4 VDC SUPPLY HI JG 0023	14 VDC SUPPLY LO WG 0022	14 VDC SUPPLY HI JG 0022	IG STEP INPUT JG 2505	MG STEP INPUT JG 2506	OG STEP INPUT JG 2507	LGC MARGIN TEST ENABLE JG 0021
(D)	(C)	(B)	(A)	(D)	(C)	(B)	(A)

R-START SIGNAL ARRANGEMENT B

FIGURE 6B


TWO LINES, 14 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
LINK NUMBER
MEASUREMENT NUMBER

7 A. - METER IDENTIFICATION INSERT


TWO LINES,11 CHARACTERS & SPACES PER LINE
NOTATIONS BELOW THIS LINE DO NOT APPEAR
INDICATOR COLOR
LINK NUMBER
MEASUREMENT NUMBER
CHANNEL NUMBER

7 B. - EVENT INDICATOR DISPLAY FORMAT

FIGURE 7

4. QUALITY ASSURANCE PROVISIONS

4.1 INSPECTION. The requirements specified in Section 3 shall be verified by visual inspection.

5. PREPARATION FOR DELIVERY.

This section is not applicable to this specification.

6. NOTES.

6.1 VARIATIONS TO SIGNAL ARRANGEMENT. Signal arrangements within a display module or assembly may be varied, but the signals shall be retained by the original module or assembly specified. The signal arrangement for the CRT display (3.4) shall be restricted to variations within the half page specified.

6.3.7.23

VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00800 ENTR
+00100 ENTR
-00800 ENTR

6.3.7.24 On CRT verify the following:

OG 1X Resolver Sin (11°) is between +06.50° and +09.50° (GG2181).
IG 1X Resolver Sin (11°)is between -00.50 and +02.50 Deg (GG2121)
MG 1X Resolver Sin (11°) is between -06.50 and -09.50 Deg (GG2151).

6.3.7.25 On K-148 enter the following:

VERB 41	NOUN 20	ENTR
+00000		ENTR
+00000		ENTR
+00000		ENTR

APOLLO G&N Specification
ND 1002323 REV A

Original Issue Date:
Release Authority: TDRR 31026
Class A Release

POST-INSTALLATION CHECKOUT SPECIFICATION
FOR LEM GUIDANCE AND NAVIGATION SYSTEM

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	APPROVALS	
				AC	NASA
11/23/66	A	32056	1-83 Was 83 pages, now 80 pages.	EA	WLS

This specification consists of page 1 to 80 inclusive.

APPROVALS	NASA/MSC			ACED 9/13/66

1. INTRODUCTION

1.1 The individual Spacecraft (SC) installed Guidance and Navigation (G&N) System to be checked out per the process specification shall consist of one of each of the following major assemblies. Refer to drawing 6015000 for specific system dash numbers effectivities.

Assembly Name	Part Number
1 - Apollo Guidance Computer Group	6003001-XXX
1 - Inertial Meas. Unit & Pulse Torque Assembly	6007001-XXX
1 - Coupling Data Unit	2007222-XXX
1 - Power and Servo Assembly	6007200-XXX
1 - Computer Control & Reticle Dimmer Assembly	6014512-XXX
1 - G&N Interconnect Harness Assembly (LEM)	6014515-XXX
1 - Signal Conditioner Assembly	
1 - Navigation Base Assembly (LEM)	6899950-XXX
1 - Alignment Optical Telescope (LEM)	6011000-XXX

1.2 The G&N System herein shall be identified as Part #6015000. The computer contains the AURORA 88 program test ropes in the core rope memory.

2. SCOPE

2.1 This specification outlines the checkout requirements for G&N System installed in a LEM VEHICLE. Addendum to this specification will cover any special checkout requirements associated with individual vehicles and G&N Systems.

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3. APPLICABLE DOCUMENTS

3.1

Document Number	Subject
LIS-540-10001	LEM-PGNS Functional Interface
LID-340-10000	ICD-PGNS (LGC-CDU-PSA and Sig. Cond.) Instl.
LID-340-10010	ICD-LEM DSKY Installation
LID-280-10004	ICD-IMU-AOT-NVB-PTA Installation
LID-390-10001	ICD-LEM Wiring Electrical Interface for PGNS
LID-540-10001	ICD-LEM-PGNS Functional Interface Flow Diagram
LIS-510-10001	Thermodynamic Requirements of Guidance & Navigation Equipment - GAEC
LIS-520-10001	LEM Design Environment
LIS-350-10002	LEM-PGNS Lateral and Forward Velocity Interface
LIS-370-10007	LEM PGNS 800 CPS Power Electrical Interface
LIS-370-10003	LEM-PGNS Measurement Interface
LIS-370-10004	LEM-LGC Electrical Interface
LIS-390-10002	Guidance and Navigation Prime Power Requirements and Characteristics
LID-410-10002	ICTC System Interface
LID-410-10003	PSA Adapter Module Interface

3.2 The following addendums are applicable to this document:

3.2.1 Addendum I LEM 1

4. MATERIAL AND EQUIPMENT

4.1 The following test equipment shall be used to perform the requirements of this specification. If protection to personnel and equipment is not decreased, items, except government furnished parts, equivalent to those listed may be used.

ITEM	DESCRIPTION	MODEL NO.
1	Water Conditioner and Transfer Unit	430-5030
2	Vehicle Ground Power Supply	410-82140-1
3	Data Acquisition System	410-9700
4	ACE - S/C Ground Station	410-11990-1
5	Carry-On Cable Set	410-11170
6	10 Volt Power Supply PCMTEA	410-72021
7	Carry On PCM System	410-92210-3
8	Digital Signal Conditioner and Multiplex Unit C-O	410-92211
9	Analog Signal Conditioner and Sample Unit C-O	410-92212
10	General Signal Conditioner and Switch Matrix Unit C-O	
11	Data Interleaver System, Miniaturized	410-92232
12	Service Equipment Adapter ACE	410-92240
13	Digital CMB System Service Equipment	410-92241
14	ACE - S/C Support Platform	420-73100
15	Junction Box - 4 units	410-12731
16	Intercom Cable Set	410-0110
17	Intercom Patch Panel	410-09450
18	Intercom Rack Mounted	410-09470-1
19	Intercom Rack Mounted	410-09470-3
20	Intercom Power Supply	410-09472
21	Intercom Test Cord	410-09480
22	GAEC Test Facility Cable Set	410-11090-15
23	ACE - S/C GSE DC Power Supply	410-11270
24	D/S Signal Conditioner Unit	419-92484
25	PSA Adapter	410-31080
26	Portable Temperature Controller	410-31058
27	Breakout Box	410-1210-1
28	Electronic Counter	HP-5245L
29	Plug In Preset Unit	HP-5264A
30	5 Place Sine-Cosine Tables, Friden Calculator	
31	Dioptometer	

5. GENERAL REQUIREMENTS

5.1 SAFETY REQUIREMENTS

5.1.1 Operator Safety

5.1.1.1 Normal safety precautions shall be observed through the G&N post-installation checkout.

5.1.2 Equipment Safety

5.1.2.1 To preserve the operational life of the components of the G&N hardware under test, settings and adjustments shall be performed only when specified in the test procedure. Care shall be exercised in the accomplishment of all settings and adjustments to avoid excessive wear or damage to the equipment. All precautionary measures stated throughout the test procedures shall be strictly adhered to.

5.1.2.2 Prior to the electrical connection of the G&N System to the spacecraft harness, a complete verification of spacecraft power, including both voltage polarity as well as magnitude, shall be completed to preclude damage to the G&N due to incorrect power application.

5.1.2.3 The connection between the Portable Temperature Controller (PTC) and 56J1 shall be maintained unless otherwise specified.

5.1.2.4 The temperature of the inertial components shall be maintained between the following limits. If these limits are exceeded, the inertial components shall be recalibrated.

a. IRIG: 120 Deg F and 150 Deg F
b. PIP: 115 Deg F and 145 Deg F

5.1.2.5 All personnel concerned shall thoroughly understand the Operational Requirements in Section 6.2 to preclude any damage to the G&N System.

5.2 COOLANT REQUIREMENTS

5.2.1 When electrical power is applied to the G&N System, the IMU shall be provided with water-glycol coolant at a temperature of 32 to 50 Deg F and a flow rate of 33±5 pounds per hour.

5.2.2 The PSA, CDU, and PTA cold plates shall be provided with coolant as per ICD LIS-510-10001.

5.3 TEST EQUIPMENT TOLERANCES

5.3.1 Measurement and tolerance specifications stated herein are basic G&N system performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. Final tolerances must include PSAAM and SCA stability uncertainties. All uncertainties due to instrumentation shall be root sum squared with the basic G&N tolerances to yield an acceptable tolerance for use when testing the G&N system in the spacecraft.

5.3.2 In the event of a conflict between requirements, the following order of precedence shall apply. The contractor shall also notify AC Electronics Site Manager of the conflict.

a. The contract
b. This specification
c. Documents referenced in this specification

5.4 TEST SEQUENCE

5.4.1 The test sequence shall normally follow the flow gram in Figure 1. Any test subsequent to Temperature Control Verification Section 6.3.4 may be conducted providing the General Turn On Procedure 6.2.4 is followed.

5.5 The generation of a noise alarm indication, as evidenced by one or more Noise Peak Event lamps becoming lighted shall be cause for immediate determination of effects on the G&N system test in progress. In the event of detrimental effects on the system test a troubleshooting routine shall be entered to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.

5.6 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N System as non-conforming. Normal test sequence may be continued upon determination of the cause of the nonconformance or at the discretion of the G&N contractor test team if it is determined that such action is not detrimental to the G&N System or other interfacing subsystems. All nonconformances shall be investigated and cleared by waivers (F.N.N.), correction of specification, or hardware replacement and retest. The suspected malfunctioned hardware shall be removed and returned to the laboratory where the malfunction shall be verified. Only after malfunction verification shall a flight certified replaceable element be installed in the G&N System.

5.7 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps pertaining directly to the G&N components. If any questions arise concerning the test equipment, the Test Conductor should refer to the respective operational manuals.

5.8 Spacecraft systems other than the G&N System may be operating on a noninterfering basis while individual system checkout of the G&N is being conducted.

Paragraph No.	Test Title
6.3.1	Standby Power In Test
6.3.2	Alarms and Interrupts Test
6.3.3	IMU Operate Power On Test
6.3.4	Temperature Control Verification
6.3.5	PGNCS Power Supply Test
6.3.6	IMU Operational Test
6.3.7	PGNCS Operational Test
6.3.8	IRIG Scale Factor Test
6.3.9	IMU Performance Test
6.3.10	LGC Voltage Margin Test
6.3.11	LGC Clock Frequency Test
6.3.12	Gimbal Friction Test
6.3.13	Stabilization Loop Response Test
6.3.14	G&N Fine Alignment Test
6.3.15	AOT Functional Performance Test

TEST SEQUENCE

FIGURE 1

5.9 DATA RETRIVAL

5.9.1 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance reading shall be recorded and flagged by appropriate signals.

5.9.2 During G&N system testing, all interleaved data, Uplink Command Files and Downlink Data File shall be maintained (recorders On). All A/B PCM data that is not made available to the ACE displays shall be verified by requesting a time history data strip out of said data for the time period when the test was performed.

6. DETAILED REQUIREMENTS

6.1 INITIAL TEST CONDITIONS

6.1.1 The IMU shall be supplied with heater power on a continuous basis. The Portable Temperature Controller (Model No. 410-31058) shall be connected at all times although heater power may be supplied from the +28 VDC IMU STANDBY bus and monitored through ACE.

6.1.2 The IMU shall never be without heater power longer than 15 minutes.

6.2 OPERATIONAL REQUIREMENTS

6.2.1 Emergency Shutdown Procedure

CAUTION

In the event of any malfunction which might damage the G&N System before the normal shutdown procedure in 6.2.2 can be performed, power shall be removed from the G&N System as soon as possible. If at all possible, without creating any delay, IMU Operate power should be removed first.

6.2.2 Normal Shutdown Procedure.

6.2.2.1 The normal shutdown of a G&N System shall include parking the gimbals prior to removing IMU Operate Power. This is accomplished in the following procedure.

6.2.2.2 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+09000 ENTR

6.2.2.3 On the CRT, verify the following gimbal angles are displayed:

IG is between 358 and 002
MG is between 088 and 092
OG is between 358 and 002
Verify Gimbal Lock Lamp is lighted.

6.2.2.4 Pull out +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel XI to remove IMU OPERATE power.

6.2.2.5 Pull out +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel XI to remove LGC OPERATE power.

6.2.2.6 Pull out +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel XI to remove IMU STANDBY power.

6.2.3 Initial Turn-On Procedure

6.2.3.1 Proper coolant flow shall be verified prior to application of any power to the G&N System.

6.2.3.2 The initial power turn-on sequence shall be in the order specified in the test procedures (6.3) observing all cautions and delays as specified.

6.2.4 General Turn-On Procedure

6.2.4.1 This step shall be effective only after having completed the initital turn-on procedures.

6.2.4.2 Proper coolant flow shall be verified.

6.2.4.3 Depress +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11 to supply IMU STANDBY power.

6.2.4.4 Depress +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11 to supply LGC Operate power.

6.2.4.5 Depress STBY pushbutton on DSKY for 3 seconds and verify STBY light on DSKY is off.

6.2.4.6 On K-148 enter the following sequence:

ERROR RESET
VERB 36 ENTR (fresh start)
VERB 57 ENTR
00015 ENTR (clear erasable memory)
VERB 21 NOUN 27 ENTR
77777 ENTR (LGC Self Check)

6.2.4.7 On the CRT, verify that the 3.2KC 28V Supply indicates between 28.04 and 29.16 VRMS (CG 1331).

6.2.4.8 On the CRT, verify that R1 does not display 01102 or 41102 (indicating a malfunction).

6.2.4.9 After 5 minutes, stop LGC Self Check by entering the following in K-148:

VERB 21 NOUN 27 ENTR
00000 ENTR

6.2.4.10 CAUTION: LGC OPERATE AND IMU STANDBY power must have been applied a minimum of two hours before energizing the IMU OPERATE circuit breaker in step 6.2.4.16 unless all of the following conditions are met:

IF: 1. The G&N System has previously been in Standby Mode at least two hours and subsequently been in Operate Mode, AND

2. The gimbals were placed in a parked position prior to shutdown, AND

3. The shutdown period did not exceed 5 days, AND

4. The Spacecraft or IMU have not been moved in any way during the shutdown period.

THEN: The two-hour standby Mode operation requirement is reduced to 90 seconds.

6.2.4.11 The G&N System is defined as being in Standby Mode when LGC Operate and IMU Standby power is applied and IMU Operate power is off. The inertial components shall have suspension power in Standby Mode.

6.2.4.12 The G&N System is defined as being in Operate Mode when LGC OPERATE, IMU STANDBY and IMU Operate Power is applied to the system.

6.2.4.13 Set up analog recorder to monitor the following signals:

	Signal No.	Signal Name
a.	GG 2136	MG Servo Error Total
b.	GG 2106	IG Servo Error Total
c.	GG 2166	OG Servo Error Total
d.	GG 2112	IG 1X Resolver Sine
e.	GG 2172	OG 1X Resolver Sine
f.	GG 2142	MG 1X Resolver Sine
g.	GG 1201	IMU 28V 1% 800 CPS

6.2.4.14 Start the analog recorder to a chart speed of 5 mm/sec. Start event recorder to a chart speed of .10 mm/sec. (10/100 mm/sec.).

6.2.4.15 On CRT, monitor +120 VDC PIPA SUPPLY (GG1040) and on IMU gimbal angles.

6.2.4.16 Press in +28VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.2.4.17 Verify on analog recorder that the oscillations of the resolver sine signals (GG 2112, GG 2172 and GG 2142) are not sustained and that the signals damp out within 15 seconds. If this condition is not attained, remove IMU OPERATE power immediately.

6.2.4.18 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.2.4.16 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.2.4.16.

6.2.4.19 Verify absence of LGC WARNING, ISS WARNING, and PGNCS CAUTION lights in the LEM cabin.

6.2.4.20 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.2.4.21 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.2.4.22 On the CRT, scan the power supply voltages to verify their normal operation. (No indications flashing).

6.2.4.23 After all the tests of 6.3 in Figure 1 have been completed, the General Turn-On Procedure (6.2.4) and IMU Operational Test (6.3.6) shall be completed before re-running any test. Otherwise, the testing sequence shall continue in accordance with Figure 2.

6.2.5 Interruption of Power

6.2.5.1 After the system has been operating with IMU Operate power on, and a power interruption occurs for a duration not exceeding 15 minutes, a minimum of 90 seconds operation in Standby Mode is required before resuming IMU Operate power. If the power interruption was longer than 15 minutes, and the requirements of 6.2.4.10 have not been complied with, the G&N System shall be run in Standby Mode for a time interval at least equal to the duration power was off before resuming IMU Operate power. However, this period need not exceed two hours before application of IMU Operate power.

6.2.5.2 IMU Operate power shall never be applied without the presence of LGC Operate and IMU Standby Power.

6.2.5.3 The G&N System log book shall include the gimbal positions at time of power shutdown. If omitted, it shall be assumed that the gimbals were not parked prior to shutdown. The logbook shall also state if any movement of the IMU or Spacecraft has taken place after shutdown. The times of application and removal of any bus power to the G&N System shall be recorded.

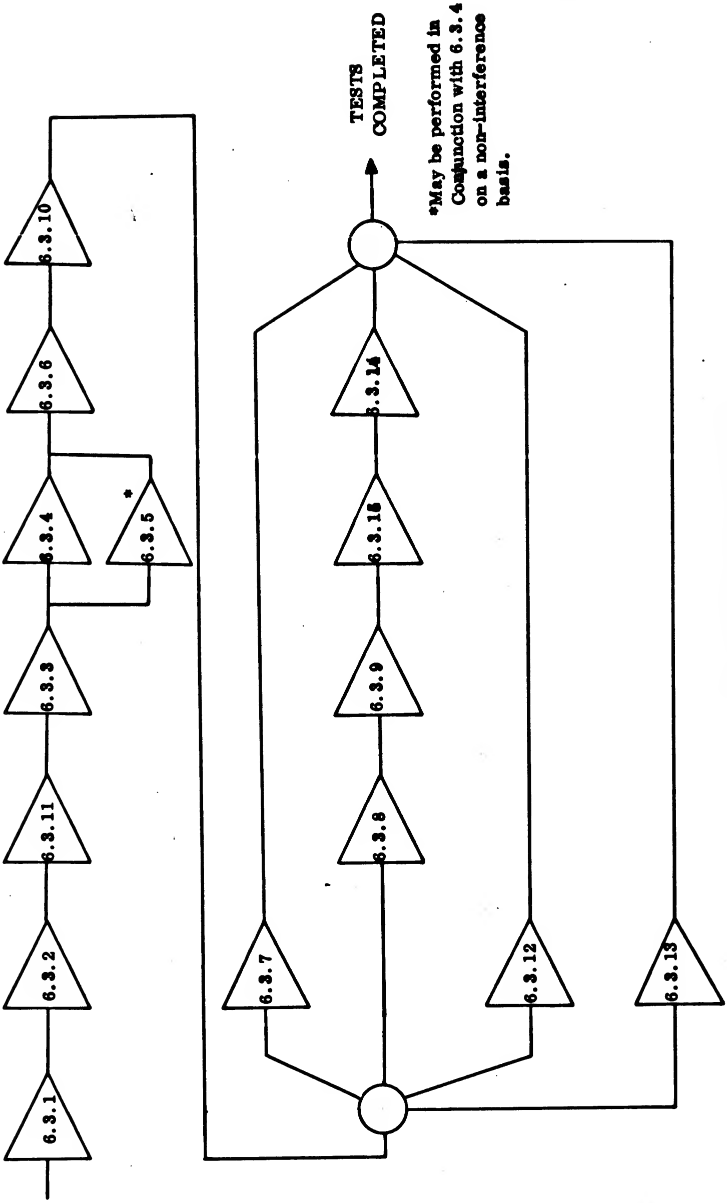
6.2.6 A warmup period of at least one hour in Operate mode is required prior to performing any test in which gyro or accelerometer parameters are measured, and at least 15 minutes prior to any test in which precision amplitude and frequency power supply checks are made.

6.3 TEST PROCEDURES

6.3.1 Standby Power On Tests

6.3.1.1 The Portable Temperature Controller, Model No. 400-31058 shall be supplying inertial component heater power to the G&N System through connector 56J1 (P230). If alarm or fail indications are present on the PTC, they shall be cleared by depressing the SYSTEM RESET pushbutton on the PTC.

6.3.1.2 Verify that spacecraft power checks, including both polarity as well as magnitude on the spacecraft power connectors, have been accomplished.



*May be performed in Conjunction with 6.3.4 on a non-interference basis.

TEST PROCEDURE FLOWGRAM

FIGURE 2

6.3.1.3 The following switches and/or circuit breakers shall be closed to energize the indicated buses.

LOCATION	NOMENCLATURE	IDENTIFICATION
Panel 14	BAT 5 NORMAL FEED	4S10
Panel 14	BAT 6 NORMAL FEED	4S11
Panel 16	X LUNAR BUS TIE	4CB5
Panel 16	BAT 1-4-6 FEED TIE	4CB17
Panel 16	BAT 2-3-5 FEED TIE	4CB25
Panel 16	ASC ECA	4CB14
Panel 16	ASC ECA CONT.	5CB7
Panel 16	DC BUS VOLT	4CB21
Panel 16	DISP.	4CB16
Panel 11	X LUNAR BUS TIE	4CB4
Panel 11	BAT 1-4-6 FEED TIE	4CB18
Panel 11	BAT 2-3-5 FEED TIE	4CB26
Panel 11	ASC ECA	4CB15
Panel 11	ASC ECA CONT.	4CB6
Panel 11	DC BUS VOLT	4CB22
Panel 16	INV. NO. 2	4CB13
Panel 14	AC PWR to INV 2 Position	4S14
Panel 11	AC BUS FEED TIE	4CB24
Panel 11	AC BUS VOLT	4CB27

6.3.1.4 IMU Standby Power Turn On

6.3.1.4.1 Turn on Event Recorder to a speed of .10 mm/sec. (10/100 mm/sec.).

6.3.1.4.2 Press in +28VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11. Record time.

6.3.1.4.3 Verify on event recorder that +28 VDC IMU STANDY power discrete (GG 1513) is on. On CRT, +28V IMU STANDBY Bus (GG 1510) shall indicate between 24.5 and 33.5.

6.3.1.4.4 On CRT, the 28V 3200 CPS SUPPLY (GG 1331) shall indicate between 28.04 and 29.16 VRMS. Record this value.

6.3.1.4.5 The PIPA TEMP displayed on CRT, shall be monitored periodically for one hour to ensure that the PIPA Temperature Control circuitry is operating to maintain a temperature of 130±5.0 DEG F. (GG 2300). Two hours after performing step 6.3.1.4.2 record PIPA TEMP.

6.3.1.5 Computer Power Turn On

6.3.1.5.1 Press in +28VDC LGC OPERATE circuit breaker (in LEM Cabin Panel 11.
Panel 11.

6.3.1.5.2 Depress STBY pushbutton on DSKY for three seconds and verify STBY light on DSKY is OFF.

6.3.1.5.3 On CRT, +28V LGC Operate Bus (GG1520) shall indicate between (24.5 and 33.5). Ignore computer alarm indications. Using DSKY, enter VERB 36, then press RSET. All computer alarms shall clear.

6.3.1.5.4 On CRT, the +14VDC LGC SUPPLY (GG 1020) shall indicate between 13.8 and 14.2 VDC. Record this value.

6.3.1.5.5 On CRT, the +4 VDC LGC SUPPLY (GG 1030) shall indicate between 3.85 and 4.15 VDC. Record this value.

6.3.1.6 LGC Operational Tests

6.3.1.6.1 DSKY Check

6.3.1.6.1.1 Initiate the DSKY check by entering in the DSKY:

Press ERROR RESET
VERB 37 ENTR 00015 ENTR (clear erasable memory)
VERB 21 NOUN 27 ENTR
00011 ENTR

6.3.1.6.1.2 All the electroluminescent elements (PROG, VERB, NOUN and Row 1, Row 2, Row 3) shall display the decimal number nine (9) including the 9's. The following shall be displayed for approximately 5 seconds.

a. 9's
b. 8's
c. 7's
d. 6's
e. 5's
f. 4's
g. 3's
h. 2's
i. 1's
j. 0's
k. Minus signs in Row 1, ROW 2, ROW 3 } On concurrently for 5 seconds
l. VERB-NOUN Flashing }
m. COMP ACTY }

o. Plus signs in ROWS 1, 2, and 3 } On concurrently for 5 seconds
p. VERB-NOUN Flashing
q. COMP ACTY
r. COMP ACTY - On for 5 seconds then DSKY blanks.

6.3.1.6.1.3 The DSKY pushbuttons shall be checked by entering:

VERB 25 NOUN 01 ENTR
01740 ENTR
+00123 ENTR
-00456 ENTR
-00789 DO NOT press ENTR
The DSKY shall display +00123 in Row 1, -00456 in Row 2, and -00789 in Row 3. Press CLR pushbutton three times on DSKY. Observe that Row 1, Row 2, and Row 3 are blank.

6.3.1.6.2 Lamp Test

6.3.1.6.2.1 Initiate the Lamp Test by entering in the DSKY:

VERB 35 ENTR

6.3.1.6.2.2 The following DSKY displays shall illuminate for 5 seconds

a. UP LINK ACTY
b. NO ATT
c. STBY
d. KEY REL
e. TEMP
f. GIMBAL LOCK
g. PROG } On concurrently for 5 seconds
h. RESTART
i. TRACKER
j. OPR ERROR Flashing
k. VERB-NOUN Flashing
l. Plus 88888 in Row 1, Row 2, and Row 3

6.3.1.6.3 Uplink Check

6.3.1.6.3.1 On K-START 148; set LOAD/INHIBIT switch to LOAD, set TAPE/KEY switch to KEY, then enter the following:

ERROR RESET
VERB 25 NOUN 01 ENTR
02400 ENTR
+01234 ENTR
-56789 ENTR
+00000 ENTR

6.3.1.6.3.2 Verify the following is displayed on the DSKY.

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.4 Downlink Check

6.3.1.6.4.1 On CRT, DSKY display, verify the following is displayed:

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.5 LGC Self-Check

6.3.1.6.5.1 On K-148 enter the following sequence to initiate the LGC Self-Check:

VERB 21 NOUN 27 ENTR
77777 ENTR
VERB 15 NOUN 01 ENTR
01366 ENTR

6.3.1.6.5.2 On the CRT, DSKY display, verify that R1 does not display 01102 or 41102. If a malfunction occurs, the following is displayed:

R1 01102 or 41102
R2 XXXXX a (S FAIL) program address +1 of point of failure
R3 XXXXX number of fails

6.3.1.6.5.3 When R3 = 00002, stop the LGC Self Check by entering in K-148 the following:

VERB 34 ENTR
VERB 21 NOUN 27 ENTR
00000 ENTR

6.3.1.6.6 LGC Standby Check

6.3.1.6.6.1 On K-148 enter the following sequence:

VERB 21 NOUN 10 ENTR
00013 ENTR
02000 ENTR

6.3.1.6.6.2 On DSKY depress STBY pushbutton for approximately 3 seconds.

6.3.1.6.6.3 Verify STBY status indicator lamp is ON.

6.3.1.6.6.4 On the CRT, verify the 3.2KC 28V Supply (GG 1331) is between 28.04 and 29.16V RMS.

6.3.1.6.6.5 On DSKY depress STBY pushbutton for approximately 3 seconds to return to LGC OPERATE mode.

6.3.1.6.6.6 Verify STBY status indicator lamp is OFF.

6.3.2 Alarms and Interrupts Test

6.3.2.1 Parity Fail Test

6.3.2.1.1 On K-148 enter the following sequence

VERB 21 NOUN 02 ENTR
01600 ENTR
33777 ENTR

6.3.2.1.2 On CRT, DSKY display, verify R1 = 33777 and R3 = 01600

6.3.2.1.3 On K-148 enter the following sequence

VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.1.4 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.1.5 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.2 Rupt Lock-Interrupt Too Long

6.3.2.2.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
00001 ENTR
01600 ENTR
00003 ENTR
VERB 31 ENTR

6.3.2.2.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.2.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.3 TC Trap Test

6.3.2.3.1 On K-148 enter the following sequence

VERB 21 NOUN 01 ENTR
01600 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.3.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.3.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.4 Nightwatchman Test

6.3.2.4.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
03400 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.4.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.4.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.3 IMU OPERATE POWER ON TESTS

CAUTION

Prior to application of IMU OPERATE power in step 6.3.3.1.4, LGC OPERATE and IMU STANDBY power must have been applied to the G&N System continuously for a minimum of two hours. The only exception is when the requirements of step 6.2.4.10 are met and this does not apply for the initial application of IMU OPERATE power.

6.3.3.1 Verification of Power Turn-On

6.3.3.1.1 Set up analog recorder to monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps
h.	SPARE	

6.3.3.1.2 Start analog recorder to a chart speed of 5 mm/sec. Start event recorder to a chart speed of .10 mm/sec. (10/100 mm/sec.).

6.3.3.1.3 On CRT, monitor +120 VDC PIPA SUPPLY (GG1040) and IMU gimbal angles.

6.3.3.1.4 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel XI. Record time.

6.3.3.1.5 Verify on analog recorder that the oscillations of the resolver sine signals (GG2112, GG2172, and GG2142) are not sustained and that the signals damp out within 15 seconds. If they don't, remove IMU OPERATE power as soon as possible.

6.3.3.1.6 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.3.3.1.4 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.3.3.1.4.

6.3.3.1.7 On event recorder verify the following:

LGC WARNING is OFF (GG9001)
ISS WARNING is OFF (GG9002)
PGNCS CAUTION is OFF (GG9003)

6.3.3.1.8 On CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.3.1.9 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.4 Temperature Control Verification

6.3.4.1 When 15 minutes have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP (GG2300).

6.3.4.2 When 30 minutes have elapsed from the time of IMU OPERATE power turn-on record IRIG TEMP (GG2301).

6.3.4.3 When 1 hour has elapsed from the time of IMU OPERATE power turn-on, monitor PIPA TEMP (GG2300) and IRIG TEMP (GG2301) on the CRT. Monitor and record temperature readings every 5 minutes for one hour. Verify that each reading does not deviate from the average value of each signal by more than 0.1°F.

6.3.4.4 When 2 hours have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP and IRIG TEMP. The PIPA Temp shall be 130.5 (±1.5)°F. The IRIG TEMP shall be 135 (±2.5°)F.

6.3.4.5 The PIPA TEMP recorded in step 6.3.4.4 shall be within 0.5°F of temperature recorded in steps 6.3.1.5.5 and 6.3.4.1.

6.3.4.6 The IRIG TEMP recorded in step 6.3.4.4 shall be within 0.5°F of the temperature recorded in step 6.3.4.2.

6.3.5 PGNCS Power Supply Tests

6.3.5.1 From the CRT, confirm power supply voltages (or temperatures) are as specified and record values observed.

6.3.5.2 The PIPA Calibration Module Temperature (GG6020) shall be between +45 and +90 DEG F.

6.3.5.3 The PSA Temperature (GG6021) shall be between +60 and +110 DEG F.

6.3.5.4 The LGC Temperature (GG4300) shall be between +45 and +130 DEG. F.

6.3.5.5 The +28 VDC IMU OPERATE BUS (GG1500) shall be between 24.5 and 33.5 VDC.

6.3.5.6 The +28 VDC IMU STANDBY BUS (GG1510) shall be between 24.5 and 33.5 VDC.

6.3.5.7 The +28 VDC LGC OPERATE BUS (GG1520) shall be between 24.5 and 33.5 VDC.

6.3.5.8 The +120 VDC PIPA Supply (GG1040) shall be between 114 and 126 VDC.

6.3.5.9 The -28VDC Supply (GG1100) shall be between -21.5 and -33.5 VDC.

6.3.5.10 The +4VDC CDU Supply (GG1070) shall be between 3.8 and 4.2 VDC.

6.3.5.11 The IMU 28V 800 CPS 1 pct Supply (GG1201) shall be between 27.44 and 28.56 VRMS.

6.3.5.12 The IMU 28V 800 CPS 5 pct 90 PH Supply (GG1202) shall be between 26.6 and 29.4 VRMS.

6.3.5.13 The IMU 28V 800 CPS 5 pct 0 PH Supply (GG1203) shall be between 25.9 and 30.1 VRMS.

6.3.5.14 The 3.2 KC 28V Supply (GG1331) shall be between 28.04 and 29.16 VRMS.

6.3.5.15 The 2.5 VDC T/M Bias (GG1110) shall be between 2.4 and 2.6 VDC.

6.3.5.16 The +14 VDC LGC Supply (GG1020) shall be between 13.8 and 14.2 VDC.

6.3.5.17 The +4 VDC LGC Supply (GG1030) shall be between 3.85 and 4.15 VDC.

6.3.6 IMU OPERATIONAL TEST

6.3.6.1 On K-148 enter the following:

VERB 01 NOUN 10 ENTR
00003 ENTR
Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.6.2 On K-148 enter the following:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 02 ENTR
01300 ENTR
Record CRT DSKY Row 1 indication as ±BBBBB

6.3.6.3 Perform the following calculations:

a. $\frac{\text{BBBBB} \times 5.12}{3600}$ = CCCC.C (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours

d. DDDD. D + time of day recorded in 6.3.6.1 = time of day at which high order scalar register will overflow.

6.3.6.4 If time of day is within 12 minutes of that calculated in 6.3.6.3.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.6.3.c has passed and proceed.

6.3.6.5 In K-148 enter the following sequence:

VERB 57 ENTR
00004 ENTR

6.3.6.6 Wait 200 seconds, then verify on the CRT, that the X, Y and Z PIPA SG Output signals all indicate ±2.5 Volts but not 0.

6.3.6.7 Approximately 12 minutes after performing step 6.3.6.1, VERB 06 NOUN 66 shall flash.

6.3.6.8 From the CRT, DSKY display, read and record R1 and R2 (local gravity whole and fractional respectively). The value recorded shall be between 975.0 and 985.9 cm/sec^2.

6.3.6.9 On K-148 enter the following sequence

VERB 33 ENTR
VERB 06 NOUN 66 shall flash.

6.3.6.10 From the CRT, DSKY display, read and record the horizontal fractional component of earth rate acting on the X, Y, and Z IRIG's as displayed in R2. The value recorded shall be between .65750 and .85750.

6.3.6.11 Terminate the test by entering in K-148 the following:

VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.7 PGNCS Operational Test

6.3.7.1 Start the PGNCS Operational test by inserting the following sequence into K-148:

VERB 57 ENTR
00010 ENTR
Program 07 shall be displayed
VERB 33 NOUN 01 is displayed flashing

6.3.7.2 Command Accuracy 0°

6.3.7.2.1 On K-148, press ENTR

VERB 33 NOUN 02 is displayed flashing
Press ENTR
VERB 33 NOUN 03 is displayed flashing

6.3.7.2.2 Read and record the CRT indications of CDU's. The indications shall be 000±001 degree.

6.3.7.2.3 Read and record CRT the DSKY Row 1, 2, and 3 indications. The indications shall be +00000 ± 00006.

6.3.7.3 Command Accuracy 45°.

6.3.7.3.1 On K-148, press ENTR, VERB 33 NOUN 04 is displayed flashing after approximately 20 seconds.

6.3.7.3.2 Read and record the CRT CDU indications. The indications shall be 045 ± 001 degrees.

6.3.7.3.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +04500 ± 00006.

6.3.7.4 CDU Repeating Accuracy 45°

6.3.7.4.1 On K-148 press ENTR. In about 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.4.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.5 Command Accuracy 90°

6.3.7.5.1 On K-148 Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 06 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.5.2 Read and record the CRT CDU indications. The indications shall be 090 ± 001 degrees.

6.3.7.5.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be +09000 ± 00006.

6.3.7.6 Command Accuracy 135°

6.3.7.6.1 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 07 is displayed flashing.

6.3.7.6.2 Read and record the CRT CDU indications. The indications shall be 135 ± 001 degrees.

6.3.7.6.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +13500 ± 00006.

6.3.7.7 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 10 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.8 CDU Repeating Accuracy 135° .

6.3.7.8.1 On K-148 press ENTR pushbutton. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.8.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.9 + Gimbal Lock Test

6.3.7.9.1 On K-148, Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 12 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.10 Command Accuracy 225°

6.3.7.10.1 On K-148 press ENTR. In approximately 20 seconds, VERB 33, NOUN 13 is displayed flashing.

6.3.7.10.2 Read and record the CRT CDU indications. The indication shall be 225 ± 001 degrees.

6.3.7.10.3 Read and record CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +225 ± 00006.

6.3.7.11 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 14 is displayed. The GIMBAL LOCK lamp shall not be lighted.

6.3.7.12 CDU Command Rate Test

6.3.7.12.1 On K-148 press ENTR. In approximately 30 seconds VERB 06 NOUN 66 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.12.2 Read and record the CRT DSKY Row 1, 2, and 3 indications. The indication shall be between 00012 and 00016.

6.3.7.12.3 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.12.4 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on the DSKY shall not be lighted.

6.3.7.13 Command Accuracy 315°.

6.3.7.13.1 On K-148 insert VERB 33 ENTR. In approximately 20 seconds VERB 33 NOUN 20 will be displayed flashing.

6.3.7.13.2 Read and record CRT CDU indications of CRT. The indicator shall be 315±001 degrees. 315 ± 001 degrees.

6.3.7.13.3 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indications shall be +315 ± 00006.

6.3.7.14 CDU Repeating Accuracy 315°

6.3.7.14.1 On K-148 press ENTR. In approximately 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.14.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.15 -Gimbal Lock Test

6.3.7.15.1 On K-148 Press VERB 33 ENTR. In approximately 20 seconds VERB 33, NOUN 22 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.16 CDU Repeating Accuracy 225°

6.3.7.16.1 On K-148, press ENTR. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.16.2 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indication shall be between 77774 and 00003.

6.3.7.17 On K-148 Press VERB 33 ENTR. The GIMBAL LOCK lamp shall not be lighted. VERB 21, NOUN 22 is displayed flashing.

6.3.7.18 IMU CDU Fine Fail Test

6.3.7.18.1 On K-148 insert the following sequence

+00100 ENTR
+00100 ENTR
+00100 ENTR
On Event Module verify that ISS WARNING lamp lights.

6.3.7.18.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display Row 1 indicates 33XXX or 32XXX.

6.3.7.19 IMU CDU Coarse Fail Test

6.3.7.19.1 On K-148 insert the following sequence

VERB 33 ENTR
+03750 ENTR
+03750 ENTR
+03750 ENTR
Verify that ISS WARNING lamp Event Module lights.

6.3.7.19.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display of Row 1 indicates 33XXX or 32XXX.

6.3.7.20 FDAI Linearity Test

6.3.7.20.1 On K-148 enter VERB 33 ENTR
VERB 33 NOUN 27 shall be displayed.

6.3.7.20.2 On CRT verify the following:

PITCH ATT ERROR is between +15.3 and +18.7 DEG (GG2219)
YAW ATT ERROR is between +15.3 and +18.7 DEG (GG2249)
ROLL ATT ERROR is between +15.3 and +18.7 DEG (GG2279)

6.3.7.20.3 On K-148 press ENTR.
VERB 33 NOUN 30 shall be displayed.

6.3.7.20.4 On CRT verify the following:

PITCH ATT ERROR is between +14.4 and +17.6 DEG (GG2219)
YAW ATT ERROR is between +14.4 and +17.6 DEG (GG2249)
ROLL ATT ERROR is between +14.4 and +17.6 DEG (GG2279)

6.3.7.20.5 On K-148 press ENTR.
VERB 33 NOUN 31 shall be displayed

6.3.7.20.6 On CRT verify the following:

PITCH ATT ERROR is between +05.4 and +06.6 DEG (GG2219)
YAW ATT ERROR is between +05.4 and +06.6 DEG (GG2249)
ROLL ATT ERROR is between +05.4 and +06.6 DEG (GG2279)

6.3.7.20.6.1 On CRT verify the following:

IG 1X Resolver Sin (11°) is between +05.4 and +06.6 DEG (GG2121)
MG 1X Resolver Sin (11°) is between +05.4 and +06.6 DEG (GG2151)
OG 1 X Resolver Sin (11°) is between +05.4 and +06.6 DEG (GG2181)

6.3.7.20.7 On K-148 press ENTR.
VERB 33 NOUN 32 shall be displayed.

6.3.7.20.8 On CRT verify the following:

PITCH ATT ERROR is between +00.2 and -00.2 DEG (GG2219)
YAW ATT ERROR is between +00.2 and -00.2 DEG (GG2249)
ROLL ATT ERROR is between +00.2 and -00.2 DEG (GG2279)

6.3.7.20.9 On K-148 press ENTR.
VERB 33 NOUN 33 shall be displayed.

6.3.7.20.10 On CRT verify the following:

PITCH ATT ERROR is between -05.4 and -06.6 DEG (GG2219)
YAW ATT ERROR is between -05.4 and -06.6 DEG (GG2249)
ROLL ATT ERROR is between -05.4 and -06.6 DEG (GG2279)

6.3.7.20.11 On K-148 press ENTR.
VERB 33 NOUN 34 shall be displayed.

6.3.7.20.12 On CRT verify the following:

PITCH ATT ERROR is between -14.4 and -17.6 DEG (GG2219)
YAW ATT ERROR is between -14.4 and -17.6 DEG (GC2249)
ROLL ATT ERROR is between -14.4 and -17.6 DEG (GG2279)

6.3.7.20.13 On K-148 press ENTR.
VERB 33 NOUN 35 shall be displayed.

6.3.7.20.14 On CRT verify the following:

PITCH ATT ERROR is between -15.3 and -18.7 DEG (GG2219)
YAW ATT ERROR is between -15.3 and -18.7 DEG (GG2249)
ROLL ATT ERROR is between -15.3 and -18.7 DEG (GG2279)

6.3.7.21 On K-148 enter VERB 36 ENTR.
The proper operation of the IMU CAGE function (consisting of steps 6.3.7.33 thru 6.3.7.41) need be performed only once during the initial PGNCS Operational Test and omitted from subsequent testing of test 6.3.7.

6.3.7.21.1 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00500 ENTR
+00500 ENTR
+00500 ENTR

6.3.7.21.2 On the CRT, verify all IMU gimbal angles indicate between 003 and 007 DEG.

6.3.7.21.3 On analog recorder, monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps

6.3.7.21.4 Start analog recorder to a chart speed of 5 mm/sec.

6.3.7.21.5 On LEM Cabin Panel 4, hold IMU CAGE momentary toggle switch in the ON position. (Do not release).

6.3.7.21.6 On analog recorder, verify the 1X Resolver Sine signals (GG2112, GG2172, GG2142) null out to less than 0.5 VRMS. Release IMU CAGE switch to the OFF position. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Any sustained oscillations shall be cause for immediate removal of IMU Operate power.

6.3.7.21.7 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.7.22 Stop analog recorder.

6.3.7.23 On K-148 enter the following sequence:

VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.8 IRIG Scale Factor Determination

6.3.8.1 Insure that the IMU Operate power and LGC Operate power have been applied for a minimum of one hour and that the IMU is not in a gimbal lock condition.

6.3.8.2 On meter module monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.8.3 On K-148 enter the following sequence:

VERB 57 ENTR
00005 ENTR

6.3.8.4 PROG 07 shall be displayed.

6.3.8.5 VERB 06 NOUN 61 shall flash.

6.3.8.6 On the CRT DSKY, Verify contents of Row 1 (Navigation Base azimuth) and Row 2 (Site latitude shall be displayed).

6.3.8.7 If values for Row 1 and Row 2 are correct, proceed to the next step.
If values for Row 1 and Row 2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR
±xxxxx ENTR (Correct navigation base azimuth)
+40.748 ENTR (Correct site latitude)
Verify values in Row 1 and Row 2 are correct.

6.3.8.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.8.

6.3.8.9 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (-X IRIG Scale Factor error in part per million, Position +00001)

6.3.8.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.10.

6.3.8.11 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (-Y IRIG Scale Factor error in parts per million, Position +00002).

6.3.8.12 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.12.

6.3.8.13 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position +00003).

6.3.8.14 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.14.

6.3.8.15 In approximately 200 seconds, VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row (+X IRIG Scale Factor error in parts per million, Position -00001).

6.3.8.16 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.16.

6.3.8.17 In approximately 200 seconds, VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor error in parts per million, Position -00002).

6.3.8.18 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM is ON, enter VERB 36 ENTR and repeat steps, 6.3.8.3 through 6.3.8.7 and 6.3.8.18.

6.3.8.19 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (-Z IRIG Scale Factor error in parts per million, Position -00003).

6.3.8.20 Repeat steps 6.3.8.8 through 6.3.8.19 twice to obtain second and third set of data.

6.3.8.21 Terminate this test by entering in K-148 the following:

```
VERB 34 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR
```

6.3.8.22 The average of the three readings of Scale Factor Error for each of the 6 positions shall be 0 ± 1750 PPM.

6.3.9 IMU Performance Test. A reference data sheet is provided at the end of this section to aid in data reduction. Table I of the data sheet should be completed before the start of this test.

6.3.9.1 Insure that IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.9.2 On CRT display, monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.9.3 Adjust oscilloscope to display butterfly of X PIPA.

6.3.9.4 On K-148 enter the following:

```
VERB 01  NOUN 10  ENTR
00003             ENTR
```

Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.9.5 On K-148 enter the following:

```
VERB 21  NOUN 01  ENTR
01300             ENTR
AAAAA             ENTR
VERB 06 NOUN 02   ENTR
01300             ENTR
```

Record CRT DSKY Row 1 indications as ±BBBBB.

6.3.9.6 Perform the following calculations:

a. $\frac{\text{BBBBB} \times 5.12}{360}$ = CCCC.C (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours.

c. DDDD.D + present time of day = time of day at which high order scalar register will overflow.

6.3.9.7 If the time of day is within 12 minutes of that calculated in 6.3.9.6.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.9.6.c has passed and proceed.

Paragraph

6.3.9.15
6.3.9.22
6.3.9.30
6.3.9.36
6.3.9.43
6.3.9.48

6.3.9.8 On K-148 enter the following sequence:

VERB 57 ENTR
00001 ENTR
VERB 06 NOUN 61 shall flash

6.3.9.9 On the CRT, DSKY display verify R1 (Navigation Base Azimuth) and R2 (Site Latitude) are correct.

6.3.9.10 If values for R1 and R2 are correct, proceed to next step.
If values for R1 and R2 are incorrect, enter the following sequence into K-148.

VERB 24 ENTR
±xxx.xx ENTR (Correct navigation base azimuth ±0.50 deg)
+40.748 ENTR (Correct site latitude)
Verify values in R1 and R2 are correct

6.3.9.11 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.12 On CRT, DSKY display, verify R1 = +00600 (Time), R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position).
If values for R1, R2 and R3 are correct, proceed to next step.
If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00600 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00001 ENTR (Test Position Entry)

6.3.9.13 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.14 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 (+NBDY Position +00001).

6.3.9.15 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.16 After 100 seconds, take a photograph of Y and Z PIPA butterfly patterns on oscilloscope.

6.3.9.17 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (+X PIPA Position +00001). Row 1 is whole part, Row 2 is fractional part. Units are cm/sec^2.

6.3.9.18 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.19 On CRT, DSKY display - verify R1 = +00600, R2 = +00000, and R3 = +00002.

6.3.9.20 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.21 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDZ Position +00002).

6.3.9.22 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.23 Approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (-X PIPA Position +00002).

6.3.9.24 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.25 In approximately 67 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX + ADIAX Pos +00002).

6.3.9.26 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.27 On CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00003.

6.3.9.28 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.29 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX Position +00003).

6.3.9.30 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.31 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Z PIPA Position +00003).

6.3.9.32 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.33 On the CRT, DSKY display verify R1 = +00600, R2 = 00000, and R3 = +00004.

6.3.9.34 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.35 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDY + ADSRAY Position +00004).

6.3.9.36 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.37 After 100 seconds, take a photograph of the X-PIPA butterfly pattern on oscilloscope.

6.3.9.38 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (-Z PIPA Position +00004).

6.3.9.39 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.40 In approximately 67 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display record R2 (+NBDZ + ADIAZ Position +00004).

6.3.9.41 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.42 From the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00005.

6.3.9.43 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.44 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.45 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Y PIPA Position +00005).

6.3.9.46 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.47 On the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00006.

6.3.9.48 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.49 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.50 In approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2. (-Y PIPA Position +00006).

6.3.9.51 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.52 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000 and R3 = +00007.

6.3.9.53 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.54 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+.707 ADSRAX-NBDX Position +00007).

6.3.9.55 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.56 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00008.

6.3.9.57 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.58 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 [-.707 (NBDZ+NBDY) +0.5 (ADIAZ - ADIAY) +0.5 (ADSRAY + ADSRAZ)] (Position + 00008).

6.3.9.59 On K-148 enter the following:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash.

6.3.9.60 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00009.

6.3.9.61 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.62 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display, record R2 (-NBDZ + .707 ADSRAZ Position +00009).

6.3.9.63 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.64 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00010.

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9.14	+N BDY Position +00001	meru	( ) ---.--	a.
6.3.9.17	+X PIPA Test Position +00001	cm/sec^2	( ) 00---. ( )-----	b.
6.3.9.21	+ N BDZ Position +00002	meru	( ) ---.--	c.
6.3.9.23	-X PIPA Test Position +00002	cm/sec^2	( ) 00---. ( )-----	d.
6.3.9.25	-N BDX + ADIAX Position +00002	meru	( ) ---, --	e.
6.3.9.29	-N BDX Position +00003	meru	( ) ---.--	f.
6.3.9.31	+Z PIPA Test Position +00003	cm/sec^2	( ) 00---. ( ) -----	g.
6.3.9.35	+N BDY + ADSRAY Position +00004	meru	( ) ---.--	h.
6.3.9.38	-Z PIPA Test Position +00004	cm/sec^2	( ) 00---. ( ) -----	i.
6.3.9.40	+N BDZ + ADIAZ Position +00004	meru	( ) ---.--	j.
6.3.9.45	+Y PIPA Test Position +00005	cm/sec^2	( ) 00---. ( ) -----	k.
6.3.9.50	-Y PIPA Test Position +00006	cm/sec^2	( ) 00---. ( ) -----	l.

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9.54	-NBDX+ .707 ADSRAX Position +00007	meru		m.
6.3.9.58	-.707 (NBDZ+NBDY) +0.5 (ADIAZ-ADIAY) +0.5 (ADSRAY+ADSRAZ) Position +00008	meru		n.
6.3.9.62	-NBDZ+.707ADSRAZ Position +00009	meru		o.
6.3.9.66	.707(NBDY-NBDX) +.5 (ADIAY-ADIAX) +.5 ADSRAX Position +00010	meru		p.

DATA SHEET

CALCULATION	PARAMETER	UNITS	
line e - line f = ( ) ---.-- (-NBDX+ADIAX) - (-NBDX)	ADIAX	meru	q
line h - line a = ( ) ---.-- (+NBDY+ADSRAY) - (+NBDY)	ADSRAY	meru	r
line j - line c = ( )---.-- (+NBDZ+ADIAZ) - (NBDZ)	ADIAZ	meru	s
(line m - line f) X1.414 = ( ) ---.-- [(-NBDX + .707 ADSRAX) -(-NBDX)] X 1.414	ADSRAX	meru	t
(line o + line c) X1.414 = ( ) ---.-- (-NBDZ+.707 ADSRAZ + NBDZ) X1.414	ADSRAZ	meru	u
(line p - .707 line a -.707 line f +.5 line q -.5 line t) X2 = ---.-- [.707 (NBDY-NBDX) +.5 (ADIAY -ADIAX) +.5 ADSRAX -.707 (-NBDX) -.707 NBDY +.5 ADIAX -.5 ADSRAX] X2	ADIAY	meru	v
line b - line d = ( )	PIPA X2G	cm/sec^2	w
line k - line l = ( )	PIPA Y2G	cm/sec^2	x
line g - line i = ( )	PIPA Z2G	cm/sec^2	y
1960.52 - line w X 1 cm/sec/pulse Transfer results to line ay	X PIPA S. F.	cm/sec/pulse	z
1960.52 - line x X 1cm/sec/pulse transfer results to line az	Y PIPA S. F.	cm/sec/pulse	aa
1960.52 - line y X /cm/sec/pulse Transfer results to line ba	Z PIPA S. F.	cm/sec/pulse	ab
1/2 (line b + line d) = ( ) --.--- Transfer results to line bb	X PIPA Bias	cm/sec^2	ac
1/2 (line k + line l) = ( ) --.--- Transfer results to line bc	Y PIPA Bias	cm/sec^2	ad
1/2 (line g + line i) = ( ) --.--- Transfer results to line bd	Z PIPA Bias	cm/sec^2	ae
Perform the following calculations for values of NBD, ADSRA and ADIA. The constants are obtained from Table I. Transfer results to items ap through ax on data sheet			af
Δ NBDY = line a - NBDY Δ NBDY =		meru	ag
Δ NBDZ = line c - NBDZ Δ NBDZ =		meru	ah
Δ NBDX = (-line f) - NBDX Δ NBDX =		meru	ai
Δ ADIAX = line q - ADIAX Δ ADIAX =		meru	aj
Δ ADSRAY = line r - ADSRAY Δ ADSRAY =		meru	ak
Δ ADIAZ = line s - ADIAZ Δ ADIAZ =		meru	al
Δ ADSRAX = line t - ADSRAX Δ ADSRAX =		meru	am

DATA SHEET
(Continued)

CALCULATION	PARAMETER	UNITS	
Δ ADSRAZ = line a - ADSRAZ Δ ADSRAZ =		meru	an
Δ ADIAY = line v - ADIAY Δ ADIAY =		meru	ao

DATA SHEET

PARAMETER	UNITS	MIN VALUE	RECORDED VALUE	MAX VALUE	REJ	ACC	
Δ NBDY	meru	-5.0		+5.0			ap
Δ NBDZ	meru	-5.0		+5.0			ag
Δ NBDX	meru	-5.0		+5.0			ar
Δ ADSRAY	meru	-10.0		+10.0			as
Δ ADSRAZ	meru	-10.0		+10.0			at
Δ ADSRAX	meru	-10.0		+10.0			au
Δ ADIAX	meru	-15.0		+15.0			av
Δ ADIAZ	meru	-15.0		+15.0			aw
Δ ADIAY	meru	-15.0		+15.0			ax
X PIPA S. F. from line z	cm/sec /pulse	.9996		1.0004			ay
Y PIPA S. F. from line aa	cm/sec /pulse	.9996		1.0004			az
Z PIPA S. F. from line ab	cm/sec /pulse	.9996		1.004			ba
X PIPA Bias from line ac	cm/sec^2	-0.5		+0.5			bb
Y PIPA Bias from line ad	cm/sec^2	-0.5		+0.5			bc
Z PIPA Bias from line ae	cm/sec^2	-0.5		+0.5			bd

6.3.9.65 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.66 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 [.707 (NBDY-NBDX) +.5 (ADIAY - ADIAX) +.5 ADSRAX] (Position +00010).

6.3.9.67 Terminate this test by entering in K-148 the following:

VERB 36 ENTR

6.3.9.68 On CRT, record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).

6.3.9.69 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.10 LGC Voltage Margin Test

6.3.10.1 Initial Conditions

6.3.10.1.1 Insure that the G&N System is in Operate Mode.

6.3.10.1.2 On the CRT, verify the +28 VDC LGC OPERATE bus is between 24.5 and 33.5 vdc (GG 1520).

6.3.10.2 Voltage Margin Determination

6.3.10.2.1 On the PSA Adapter Module (PSAAM) (410-31080), place INHIBIT VOLTAGE FAIL switch to ON.

> CAUTION: The +4 vdc LGC Supply voltage shall never by operated lower than +2.5 vdc or higher than +5.2 vdc (GG 1030).
>
> The +14 vdc LGC Supply shall never be operated less than +8.5 vdc or higher than +17.0 vdc (GG 1020).
>
> NOTE: The flashing indication of the LGC supplies may be disregarded for this test. The charts in Table II may be used to determine approximate values for the "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.

6.3.10.2.2 Enter 0001 into R155. Verify and execute.

6.3.10.2.3 Enter 1111 into R154. Verify and execute.

6.3.10.2.4 Enter in C-156 ±XX.X001114. (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 12.2 (+0.3, -0) vdc. See Table II). Execute.

6.3.10.2.5 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the +4V power supply (GG 1030) as monitored on the CRT, to 3.5 (+0.15, -0) vdc. See Table II). Execute.

6.3.10.2.6 On K-148 press ERROR RESET.

6.3.10.2.7 On K-148 initiate LGC Self-Check by entering the following:

```
VERB  21  NOUN  27  ENTR
77767               ENTR
```

Wait 200 seconds. Verify RESTART lamp on the DSKY is not lit

TABLE I

JDC	PARAMETER	VALUE
16236	BDX	
16236	ADSRAX	
16237	ADIAX	
16239	BDY	
16239	ADSRAY	
16240	ADIAY	
16242	BDZ	
16242	ADSRAZ	
16243	ADIAZ	

6.3.10.2.8 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.9 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations

```
VERB  21  NOUN 27  ENTR
77767              ENTR
```

6.3.10.2.10 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 16.4 (+0, -0.4) vdc. See Table II Execute.

6.3.10.2.11 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.12 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations

VERB 21 NOUN 27 ENTR
77767 ENTR

6.3.10.2.13 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the 4V power supply (GG 1030) as monitored on the CRT, to 4.7 (+0, -0.2) vdc. See Table II). Execute.

6.3.10.2.14 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.

6.3.10.2.15 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lit. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:

VERB 21 NOUN 27 ENTR
77767 ENTR

6.3.10.2.16 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the 14V power supply (GG 1020) as monitored on the CRT, to 12.2 (+0.3, -0) vdc. See Table II). Execute.

6.3.10.2.17 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.18 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.19 On R-154 enter 0000. Execute

6.3.10.2.20 On R-155 enter 0000. Execute

6.3.10.2.21 On K-148 terminate the LGC Self-Check by entering the following:

VERB 21 NOUN 27 ENTR
00000 ENTR

6.3.10.2.22 On K-148 press ERROR RESET.

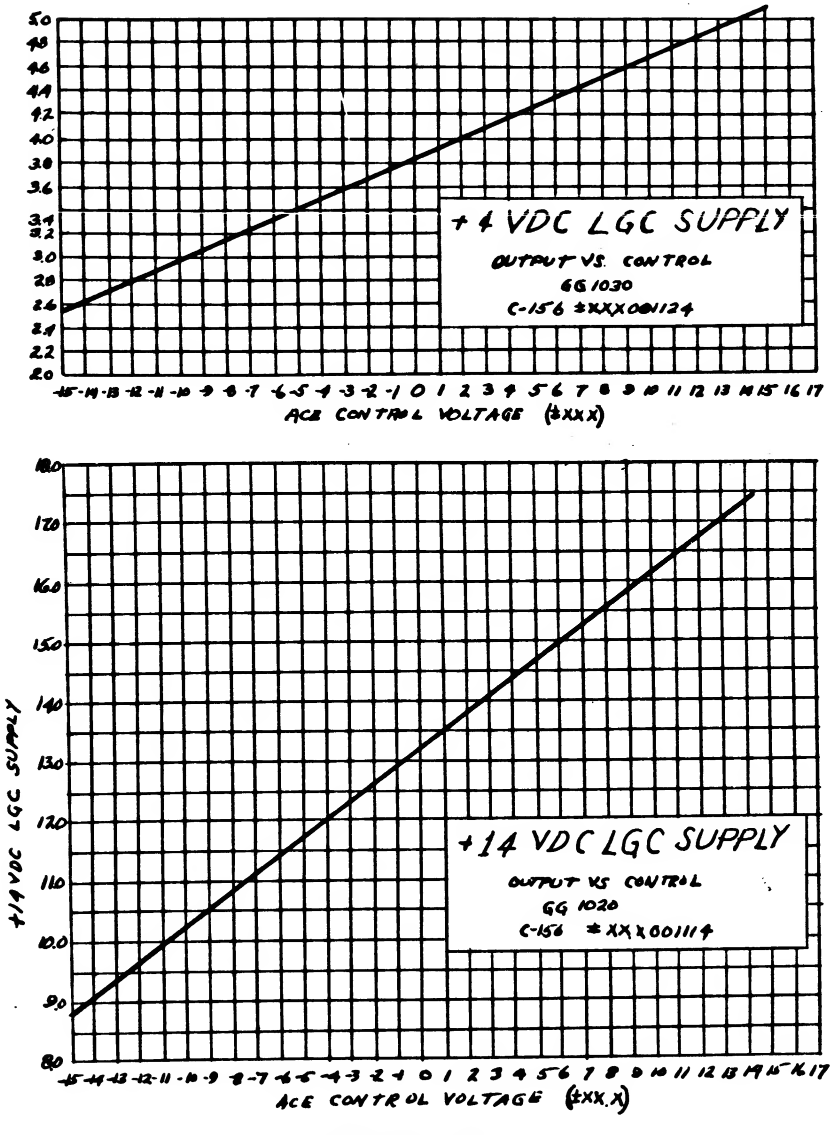

5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
ACE CONTROL VOLTAGE (±XXX)
+4 VDC LGC SUPPLY
OUTPUT VS. CONTROL
GG 1030
C-156 ±XXX001124
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
+14 VDC LGC SUPPLY
-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
ACE CONTROL VOLTAGE (±XX.X)
+14 VDC LGC SUPPLY
OUTPUT VS CONTROL
GG 1020
C-156 ±XXX001114

TABLE II

6.3.11 LGC Clock Frequency Test

6.3.11.1 Insure that LGC Operate power has been applied for a minimum of 10 minutes before performing this test.

6.3.11.2 Verify that the counter is connected to the 3.2 kc signal on the hardline.

6.3.11.3 Insure that the counter has been warming up for a minimum of 30 minutes.

6.3.11.4 On the counter,

Set the FUNCTION switch to: MAN START
Set the TIME BASE switch to: 1 μs TIME UNIT/COUNT
Set the SENSITIVITY control to: CHECK

6.3.11.5 Verify proper counter operation.

6.3.11.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.

6.3.11.7 Plug in the Preset unit and set:

MODE switch to PRESET
N switches to 96000

6.3.11.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.

6.3.11.9 Start counting by depressing RESET switch on counter.

6.3.11.10 After approximately 30 seconds, read and record counter display.

6.3.11.11 Repeat steps 6.3.11.9 and 6.3.11.10 9 times.

6.3.11.12 The average of the 10 previous readings shall be 30.000000±0.000060 seconds.

6.3.11.13 Insure that the System is not in IMU Operate.

6.3.11.14 Perform the following DSKY operations

VERB 21 NOUN 10	ENTR
00013	ENTR
02000	ENTR

Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is lighted.

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6.3.11.15 Repeat steps 6.3.11.9 through 6.3.11.12.

6.3.11.16 Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is not lighted.

6.3.11.17 On the Computer Control and Reticle dimmer assembly, press and hold MARK X pushbutton.

6.3.11.18 On the DSKY observe

VERB 05 NOUN 31
Row 1 = 00112
Prog Alarm lamp is lighted
Press Error Reset

6.3.11.19 Enter the following on K-148

VERB 11 NOUN 10 ENTR
00016 ENTR

6.3.11.20 Observe that DSKY Row 1 displays 00004.

6.3.11.21 Release MARK X pushbutton

6.3.11.22 Observe that DSKY Row 1 displays 00000.

6.3.11.23 Press and hold the MARK Y pushbutton on the Computer Control and Reticle Dimmer Assembly.

6.3.11.24 Observe that DSKY Row 1 displays 00010.

6.3.11.25 Release MARK Y pushbutton.

6.3.11.26 Observe that DSKY Row 1 displays 00000.

6.3.11.27 Press and hold the REJECT pushbutton on the Computer Control and Reticle Dimmer Assembly.

6.3.11.28 Observe that DSKY Row 1 displays 00020.

6.3.11.29 Release the REJECT pushbutton.

6.3.11.30 Observe that DSKY Row 1 displays 00000.

6.3.11.31 On the DSKY perform the following operation

VERB 36 ENTR

6.3.11.32 On the Computer Control and Reticle dimmer assembly, rotate the RETICLE BRIGHTNESS control to its minimum light intensity position. View through the AOT and verify that the reticle lamp is off.

6.3.11.33 While viewing through the AOT, slowly rotate the RETICLE BRIGHTNESS control to increase the reticle brightness until a stop is reached. Observe that the reticle brightness has increased in intensity. Return RETICLE BRIGHTNESS control to off state.

6.3.12 Gimbal Friction Test

6.3.12.1 Inner Gimbal Friction Test

6.3.12.1.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.12.1.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.1.3 Set up Analog Recorder to monitor the following signals:

MEAS. NO.	SIGNAL NAME
a. GG2110	IG Torque Motor Current
b. GG2106	IG Servo Error Total
c. GG2107	IG Servo Error In Phase
d. GG2112	IG 1x Resolver Sine
e. GG2113	IG 1x Resolver Cosine
f. GG2220	IG CDU Fine Error
g. GG1201	IMU 28V 1% 800 CPS

6.3.12.1.4 Set up Analog Recorder to monitor the following signals:

MEAS. NO.	SIGNAL NAME
a. GG2300	PIPA TEMP
b. GG2301	IRIG TEMP
c. GG1520	+28 VDC LGC OPR BUS

6.3.12.1.5 After 10 seconds has elapsed since step 6.3.12.1.1, enter the following into K-148:

```
VERB 21   NOUN 01   ENTR
00403     ENTR
00000     ENTR
```

6.3.12.1.6 Verify on CRT, DSKY display

```
VERB 21   NOUN 01
R1 =      00000
R3 =      00403
```

6.3.12.1.7 On K-148 enter the following sequence:

```
NOUN 15  ENTR
00000    ENTR    ENTR    (Push ENTR pushbutton twice)
Verify R1 =  +00000
37777    ENTR    ENTR
Verify R1 = 37777
37743    ENTR    ENTR
Verify R1 = 37743
00000    ENTR    ENTR
Verify R1 = 00000
00000    ENTR    (once)
Verify R1 = 00000
```

6.3.12.1.8 Start analog recorders using a chart speed of 10 mm/sec (IG - 360° TORQUE)

6.3.12.1.9 On K-148 enter the following sequence:

```
VERB 42  ENTR
VERB 33  ENTR
```

6.3.12.1.10 Monitor analog recorder. When the IG Torque Motor Current signal (GG2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.1.11 On K-148 enter the following sequence:

```
VERB 40   NOUN 20   ENTR   Wait 3 seconds
VERB 41   NOUN 20   ENTR
+00000    ENTR
+00000    ENTR
+00000    ENTR
```

6.3.12.1.12 On the CRT, verify CDU X, CDU Y, CDU Z all indicate +00000 (±00200).

6.3.12.1.13 After 10 seconds has elapsed since step 6.3.12.1.11 enter the following sequence into K-148:

VERB 21 NOUN 01 ENTR
00403 ENTR
00000 ENTR

6.3.12.1.14 Verify on CRT, DSKY display

VERB 21 NOUN 01
R1 00000
R3 00403

6.3.12.1.15 On K-148 enter the following sequence:

NOUN 15 ENTR
00000 ENTR ENTR (Press ENTR pushbutton twice)
Verify R1 = 00000
40000 ENTR ENTR
Verify R1 = 40000
40034 ENTR ENTR
Verify R1 = 40034
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR (once)
Verify R1 = 00000

6.3.12.1.16 Start analog recorders using a chart speed of 10 mm/sec (IG +360° TORQUE)

6.3.12.1.17 On K-148 enter the following sequence

VERB 42 ENTR
VERB 33 ENTR

6.3.12.1.18 Monitor analog recorder. When the IG Torque Motor Current signal (GG2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.2. Outer Gimbal Friction Test

6.3.12.2.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.12.2.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.3 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2167	OG Servo Error In Phase
b. GG2170	OG Torque Motor Current
c. GG2166	OG Servo Error Total
d. GG2280	OG CDU Fine Error
e. GG2172	OG 1x Resolver Sine
f. GG2173	OG 1x Resolver Cosine

6.3.12.2.4 After 10 seconds has elapsed since step 6.3.12.2.1 enter the following sequence into K-148:

VERB 21 NOUN 01 ENTR
00403 ENTR
37777 ENTR

6.3.12.2.5 Verify on CRT, DSKY display

VERB 21 NOUN 01
R1 37777
R3 00403

6.3.12.2.6 On K-148 enter the following sequence:

NOUN 15 ENTR
377435 ENTR ENTR (Press ENTR pushbutton twice)
Verify R1 = 37743
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR (once)
Verify R1 = 00000

6.3.12.2.7 Start analog recorders using a chart speed of 10 mm/sec. (OG - 360° TORQUE)

6.3.12.2.8 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.2.9 Monitor analog recorder. When the OG Torque Motor Current signal (GG2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.2.10 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+00000	ENTR		

6.3.12.2.11 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.12 After 10 seconds has elapsed since step 6.3.12.2.10, enter the following sequence into K-148.

VERB 21	NOUN 01	ENTR
00403	ENTR	
40000	ENTR	

6.3.12.2.13 Verify on CRT, DSKY display.

VERB 21	NOUN 01
R1	40000
R3	00403

6.3.12.2.14 On K-148 enter the following sequence:

NOUN 15	ENTR	
40034	ENTR	ENTR
Verify R1 =	40034	
00000	ENTR	ENTR
Verify R1 =	00000	
00000	ENTR	ENTR
Verify R1 =	00000	
00000	ENTR	ENTR
Verify R1 =	00000	
00000	ENTR	(once)
Verify R1 =	00000	

6.3.12.2.15 Start analog recorders using a chart speed of 10 mm/sec (OG +360° TORQUE)

6.3.12.2.16 On K-148 enter the following sequence

VERB 42	ENTR
VERB 33	ENTR

6.3.12.2.17 Monitor analog recorder. When the OG Torque Motor Current signal (GG2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.3 Middle Gimbal Friction Test

6.3.12.3.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+06750	ENTR		

6.3.12.3.2 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = +06750±00200.

6.3.12.3.3 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2136	MG Servo Error Total
b. GG2137	MG Servo Error In Phase
c. GG2150	MG Torque Motor Current
d. GG2143	MG 1x Resolver Cosine
e. GG2250	MG CDU Fine Error
f. GG2142	MG 1x Resolver Sine

6.3.12.3.4 After 10 seconds have elapsed since step 6.3.12.3.1, enter the following sequence into K-148:

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.3.5 Verify on CRT, DSKY display

VERB 21	NOUN 01
R1 =	00000
R3 =	00403

6.3.12.3.6 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR (Press ENTR pushbutton twice)
Verify R1 =	00000	
00000	ENTR	ENTR
Verify R1 =	00000	
00000	ENTR	ENTR
Verify R1 =	00000	
14000	ENTR	ENTR
Verify R1 =	14000	
00000	ENTR	(once)
Verify R1 =	00000	

6.3.12.3.7 Start analog recorders using a chart speed of 10 mm/sec. (MG - 135° TORQUE)

6.3.12.3.8 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.3.9 Monitor analog recorder. When MG Torque Motor Current (GG2140) drops to a quiescent level (approximately 6 minutes), stop the recorders.

6.3.12.3.10 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+06750	ENTR		

6.3.12.3.11 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = -06750±00200.

6.3.12.3.12 After 10 seconds has elapsed since step 6.3.12.3.10, enter the following sequence into K-148:

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.3.13 On the CRT, DSKY display verify:

VERB 21	NOUN 01
R1 =	00000
R3 =	00403

6.3.12.3.14 On K-148 enter the following sequence:

NOUN 15	ENTR		
00000	ENTR	ENTR	(Press ENTR pushbutton twice)
Verify R1 =	00000		
00000	ENTR	ENTR	
Verify R1 =	00000		
00000	ENTR	ENTR	
Verify R1 =	00000		
63777	ENTR	ENTR	
Verify R1 =	63777		
77777	ENTR	(once)	
Verify R1 =	77777		

6.3.12.3.15 Start analog recorders using a chart speed of 10 mm/sec. (MG +135° TORQUE)

6.3.12.3.16 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.3.17 Monitor analog recorder. When the MG Torque Motor Current signal (GG2140) drops to a quiescent level (approximately 6 minutes) stop the recorders.

6.3.12.3.18 On K-148 enter the following sequence:

VERB 41	NOUN 20	ENTR
+00000	ENTR	
+00000	ENTR	
+00000	ENTR	

6.3.12.4 Test Analysis

6.3.12.4.1 Remove the strip charts from analog recorders

6.3.12.4.2 Examine each trace carefully to detect any sharp discontinuities of the traces. Disregard all transients less than 0.5 second (5 mm) on any Torque Motor Current signal. Disregard all transients less than 0.2 second (2 mm) on any CDU Fine Error signal.

6.3.12.4.3 No Torque Motor Current signal on (GG2140, GG2170, GG2110) shall ever exceed (0.125) amp. Sensitivity on recorder is 20 ma/division.

6.3.12.4.4 No CDU Fine Error on (GG2220, GG2280, GG2250) shall ever exceed (.070) volts. Sensitivity on recorder is 50 mv/division.

6.3.13 Stabilization Loop Step Response Test

6.3.13.1 IG Response Test

6.3.13.1.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+00000	ENTR		

6.3.13.1.2 On CRT, verify IG MG, and OG gimbal angles are between 358 and 002.

6.3.13.1.3 Set up analog recorder to monitor the following:

MEAS NO.		SIGNAL NAME
a. GG2110		IG Torque Motor Current
b. GG2106	IG	IG Servo Error Total
c. GG2107	IG	IG Servo Error In Phase
d. GG2112		IG 1X resolver Sine
e. GG2113		IG 1X Resolver Cosine
f. GG2220		IG CDU Fine Error
g. GG1201		IMU 28V 1 PCT 800 CPS

6.3.13.1.4 On K-148 initiate FINE ALIGN by entering the following sequence:

VERB 42	ENTR
+00000	ENTR
+00000	ENTR
+00000	ENTR

6.3.13.1.5 On the CRT verify CDU X, CDU Y and CDU Z indicate +00000±00200.

CAUTION: If the transients caused by the subsequent step input do not damp out within 15 seconds, remove IMU Operate Power.

6.3.13.1.6 Enter 1000 into R-START 155.

6.3.13.1.7 Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the IG stabilization loop.

6.3.13.1.8 Prepare to start analog recorder at a chart speed of 100 mm/sec. (IG RESPONSE TEST)

6.3.13.1.9 Enter 0000 into R-START 155. Start analog recorder.✓ Press the XEQ/SEAL pushbutton to remove the step input to the IG stabilization loop.

6.3.13.1.10 After the transient on the recorder has died out, stop the recorder.

6.3.13.1.11 From the Servo Error In Phase signal recorder trace measure the time interval (T1, Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period T1, shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.

6.3.13.2 MG Response Test

6.3.13.2.1 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2136	MG Servo Error Total
b. GG2137	MG Servo Error in Phase
c. GG2140	MG Torque Motor Current
d. GG2143	MG 1X Resolver Cosine
e. GG2250	MG CDU Fine Error
f. GG2142	MG 1X Resolver Sine
g. GG1201	IMU 28V 1% 800 cps

6.3.13.2.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).

CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU Operate power.

6.3.13.2.3 Enter 0100 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to 155 to enter the DC step voltage into the MG stabilization loop.

6.3.13.2.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (MG RESPONSE TEST).

6.3.13.2.5 Enter 0000 into R-START 155. Start analog recorder. Press XEQ/SEAL [illegible] pushbutton to remove the step input to the MG stabilization loop.

6.3.13.2.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.2.7 From the Servo Error In Phase signal recorder trace measure the time interval (T1 Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig 3). The period, T1, shall not exceed 0.1 seconds and the trace shall have no more than 3 overshoots.

6.3.13.3 OG Response Test

6.3.13.3.1 Set up analog recorder to monitor the following:

MEAS. NO.		SIGNAL NAME
a.	GG2167	OG Servo Error In Phase
b.	GG2170	OG Torque Motor Current
c.	GG2166	OG Servo Error Total
d.	GG2280	OG CDU Fine Error
e.	GG2172	OG 1X Resolver Sine
f.	GG2173	OG 1X Resolver Cosine
g.	GG1201	IMU 28V 1% 800 cps

6.3.13.3.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).

CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU operate power.

6.3.13.3.3 Enter 0010 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the OG stabilization loop.

6.3.13.3.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (OG RESPONSE TEST).

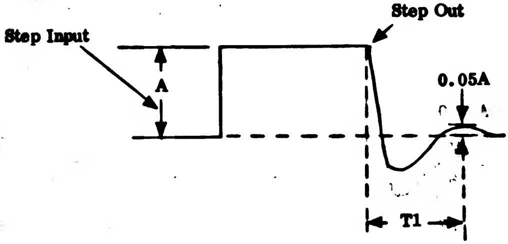
6.3.13.3.5 Enter 0000 into R-155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the OG stabilization loop.

6.3.13.3.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.3.7 From the Servo Error In Phase signal recorder trace, measure the time interval (T1, Fig 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig 3). The period, T1, shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.

6.3.13.3.8 On K-148 enter the following sequence:

VERB 41	NOUN 20	ENTR
+00000	ENTR	
+00000	ENTR	
+00000	ENTR	



TYPICAL STAB LOOP RESPONSE TO STEP INPUT

FIGURE 3

6.3.14 G&N Fine Alignment Test

6.3.14.1 On K-148 enter:

VERB 01	NOUN 10	ENTR
00003		ENTR

6.3.14.2 Record CRT, DSKY Row 1 display as AAAAA and the time of day.

6.3.14.3 On K-148 enter:

VERB 21	NOUN 04	ENTR
01300		ENTR
AAAAA		ENTR
VERB 06	NOUN 02	ENTR
01300	ENTR	

6.3.14.4 Record CRT DSKY Row 1 display as ±BBBBB

6.3.14.5 Perform the following calculations:

a. $\frac{\text{BBBBBX } 5.12}{3600} = \text{CCCC.C}$ Contents of high order scalar register in hours.

b. 23.3 - CCCC.C = DDDD.D Time left in high order scalar register until overflow.

c. DDDD.D + time of day recorded in step 3 = time of day at which high order scalar register will overflow.

6.3.14.6 If the time of day is within 12 minutes of that time calculated in 6.3.14.5.c when about to complete step 6.3.14.30 wait until that time calculated in c has passed and then proceed.

NOTE: Use of Dioptometer is required for all optical sightings using AOT.

6.3.14.7 On K-148 enter:

VERB 57	ENTR
00003	ENTR

6.3.14.8 Verify CRT DSKY display as:

VERB 06	NOUN 61	(Flashing)
R1 = +13500		(SM Azimuth)
R1 = +40.748		(Site Latitude)

NOTE: If R1 and R2 indications are correct proceed to step 6.3.14.10.

6.3.14.9 On K-148 enter:

VERB 21	ENTR
+13500	ENTR
VERB 22	ENTR
+40748	ENTR

6.3.14.10 On K-148 enter:

VERB 33	ENTR	
Observe on CRT DSKY display		
VERB 21	NOUN 30	(Flashing)

6.3.14.11 On K-148 enter:

0000X	ENTER (Test position, either 1 or 2)
00000	ENTR (Use AOT)

Observe on CRT DSKY display:

VERB 06	NOUN 61	(Flashing)

Disregard Row 1, 2, and 3 indications

6.3.14.12 On K-148 enter:

VERB 21	ENTR
+XXX.XX	ENTR (L tgt. true azimuth from 6.3.15.1.14)
VERB 22	ENTR
+XXX.XX	ENTR (L tgt. elevation from 6.3.15.1.3)
VERB 23	ENTR
00001	ENTR (L tgt. number)
VERB 33	ENTR

Observe on CRT DSKY display:

VERB 06	NOUN 61	(Flashing)

Disregard Row 1, 2 and 3 indications.

6.3.14.13 On K-148 enter:

VERB 21	ENTR	
+XXX.XX	ENTR	(F tgt. true azimuth from 6.3.15.1.14)
VERB 22	ENTR	
+XXX.XX	ENTR	(F tgt. elevation from 6.3.15.1.12)
VERB 23	ENTR	
00002	ENTR	(F tgt. number)
VERB 33	ENTR	

Observe on CRT DSKY display:
VERB 51 (flashing)
R1 = 00001

6.3.14.14 On Computer Control and Reticle Dimmer Assembly, press MARK X pushbutton. Observe on DSKY display:

VERB 21 NOUN 30 (Flashing)

6.3.14.15 On DSKY press ENTR

Observe on DSKY display:

VERB 21 NOUN 43 (Flashing)

6.3.14.16 On DSKY enter:

00001 ENTR (L Detent Code)
Observe on DSKY display
VERB 21 NOUN 42 (Flashing)

6.3.14.17 Set AOT to "L" position

6.3.14.18 Rotate AOT control knob until the center of the L tgt reticle is super imposed between the double Y reticle. Record AOT counter value as LY XXX.XX.

6.3.14.19 Rotate AOT control knob until the center of the L tgt reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as LS XXX.XX.

6.3.14.20 On DSKY enter:

±XXX.XX ENTR (value of LY)
Observe on DSKY display:
VERB 22 NOUN 42 (Flashing)

6.3.14.21 On DSKY enter:

±XXX.XX ENTR (Value of LS)
Observe on DSKY display:
VERB 51 (Flashing)
R1 = 00002

6.3.14.22 On Computer Control and Reticle Dimmer Assembly, press MARK X pushbutton. Observe on DSKY display:

VERB 21 NOUN 30 (Flashing)

6.3.14.23 On DSKY press ENTR. Observe on DSKY display:

VERB 21 NOUN 43 (Flashing)

6.3.14.24 On DSKY enter:

00002 ENTR (F Detent Code)
Observe on DSKY display:
VERB 21 NOUN 42 (Flashing)

6.3.14.25 Set AOT to "F" position

6.3.14.26 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double Y reticle. Record AOT counter value as FY XXX.XX.

6.3.14.27 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as FS XXX.XX.

6.3.14.28 On DSKY enter:

±XXX.XX ENTR (value of FY)
Observe on DSKY display:
VERB 22 NOUN 42 (Flashing)

6.3.14.29 On DSKY enter:

±XXX.XX ENTR (value of FS)

NOTE: Wait until DSKY display indicates VERB 51 (Flashing) R1 = 00001 before proceeding.

NOTE: Before completing step 6.3.14.30 check time of day to verify that the high order scalar will not overflow within the next 12 minutes.

6.3.14.30 Repeat steps 6.3.14.14 through 6.3.14.29.

6.3.14.31 In approximately 7 minutes, observe on CRT DSKY display and record.

VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Where number part of Y_{sm} misalignment about Z_{sm})
R2 = .XXXXX (Fractional number part of Y_{sm} misalignment about Z_{sm}.)

6.3.14.32 On K-148 enter.

VERB 33 ENTR
Observe on CRT DSKY display and record:
VERB 06 NOUN 66 (Flashing)

R1 = XXXXX (Whole number part of Z_{sm} misalignment about Y_{sm})
R2 = .XXXXX (Fractional number part of Z_{sm} misalignment about Y_{sm})

6.3.14.33 On K-148 enter:

VERB 36 ENTR
Press ERROR RESET

6.3.14.34 Repeat steps 6.3.14.7 through 6.3.14.30.

6.3.14.35 In approximately 7 minutes, observe on CRT DSKY display and record:

VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Whole number part of Xsm misalignment about Ysm)
R2 = .XXXXX (Fractional number part of Xsm misalignment about Ysm)

6.3.14.36 On K-148 enter:

VERB 33 ENTR
Observe on CRT DSKY display and record:
VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Whole number part of Ysm misalignment about Xsm)
R2 = .XXXXX (Fractional number part of Ysm misalignment about Xsm)

6.3.14.37 On K-148 enter:

VERB 36 ENTR
Press ERROR RESET
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.14.38 **Results.** The PIPA bias determined previously in the IMU Performance Test (6.3.9) must be subtracted from the resultant data of the test.

6.3.14.38.1 Y PIPA misalignment

R1 R2
About Z axis (from 6.3.14.31) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Y PIPA bias (from 6.3.9) = -(±XXXXX. XXXXX) $\widehat{\text{sec}}$
Y PIPA misalignment about Z axis = ------.------ $\widehat{\text{sec}}$
This value shall not exceed ±$\underline{340}$ $\widehat{\text{sec}}$

6.3.14.38.2 Z PIPA misalignment

R1 R2
About Y axis (from 6.3.14.32) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Z PIPA bias (from 6.3.9) = - (±XXXXX. XXXXX) $\widehat{\text{sec}}$
Z PIPA misalignment about Y axis = ± ------.------ $\widehat{\text{sec}}$
This value shall not exceed ±$\underline{340}$ $\widehat{\text{sec}}$

6.3.14.38.3 Z PIPA misalignment

R1 R2
About Y axis (from 6.3.14.35) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less X PIPA bias from (6.3.9) = -(±XXXXX. XXXXX) $\widehat{\text{sec}}$
X PIPA misalignment about Y axis = ±------. ------ $\widehat{\text{sec}}$
This value shall not exceed ±$\underline{340}$ $\widehat{\text{sec}}$

6.3.14.38.4 Y PIPA misalignment

R1 R2
About X axis from (6.3.14.36) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Y PIPA bias (from 6.3.9) = -(±XXXXX. XXXXX) $\widehat{\text{sec}}$
Y PIPA misalignment about X axis = ±------.------ $\widehat{\text{sec}}$
This value shall not exceed ±$\underline{340}$ $\widehat{\text{sec}}$

6.3.15 AOT Functional Accuracy Test

NOTE: Use of a Dioptometer is required when sighting through AOT.

6.3.15.1 Determination of Detent Angle Reference.

NOTE: The included angles between targets LOS shall be known to ±10 arc seconds. The elevation of each target LOS shall be known to ±15 arc seconds.

6.3.15.1.1 Place AOT in L detent position.

NOTE: Communication between AOT and target theodolite operators is required.

6.3.15.1.2 While viewing through AOT, instruct the target L operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target L, until the target reticle appears in the lower right quadrant of the AOT field of view.

NOTE: The target theodolite base must be level when alignment is achieved.

6.3.15.1.3 Upon alignment, zero the azimuth dial and record the elevation indication of target L as ϕ_1.

6.3.15.1.4 Place AOT in R detent position.

6.3.15.1.5 While viewing through AOT, instruct the target R operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target R, until the target reticle appears in the lower left quadrant of the AOT field of view.

6.3.15.1.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record the target R elevation dial indication as ϕ_3. Zero the target R azimuth dial. Record AOT dial indication as RY = XXX.XX.

6.3.15.1.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT dial indication as RS = XXX.XX.

6.3.15.1.8 Collimate L and R targets on each other, record each target azimuth with each target LOS leveled.

Target L az = α_1, Target R as = α_3

6.3.15.1.9 Place the AOT in F detent position.

6.3.15.1.10 Move the R target theodolite to a position in front of the AOT F detent position. (The target shall now be referred to as the F target).

6.3.15.1.11 While viewing through the AOT, instruct the target F operator to translate (vertically and laterally) and rotate(in azimuth and elevation) target F until the center of the target reticle appears in the center of the AOT reticle.

6.3.15.1.12 Upon alignment, zero the azimuth dial and record the elevation indication of target F as ϕ_2.

6.3.15.1.13 Collimate L and F targets on each other, record each target azimuth with each target LOS leveled. Target F az = α_2.

6.3.15.1.14 Determine the true azimuth of targets L and F with respect to the AOT. The target azimuth shall be known to within 0.5 arc degrees.

6.3.15.1.15 Rotate the F target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.12.

6.3.15.1.16 Rotate the L target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.13.

6.3.15.1.17 Calculate the values of the included angles between target L and F as X_1 and targets L and R as X_2.

$$X_1 = \cos^{-1}\left\{\sin\phi_1 \sin\phi_2 + \cos\phi_1 \cos\phi_2 \cos\left[180-(\alpha_1+\alpha_2)\right]\right\}$$
$$X_2 = \cos^{-1}\left\{\sin\phi_1 \sin\phi_3 + \cos\phi_1 \cos\phi_3 \cos\left[180-(\alpha_3+\alpha_1)\right]\right\}$$

Where: α_1 = az value, step 6.3.15.1.8
α_2 = az value, step 6.3.15.1.13
α_3 = az value, step 6.3.15.1.8

6.3.15.2 Computer Loading of Detent Calibration Data

6.3.15.2.1 On K-148 enter:

VERB 21	NOUN 03	ENTR
01462		ENTR
XXX.XX		ENTR (Detent L az data)
		ENTR
01463		ENTR
XXX.XX		ENTR (Detent F az data)
		ENTR
01464		ENTR
XXX.XX		ENTR (Detent R az data)
		ENTR
01465		ENTR
XXX.XX		ENTR (Detent L EL data)
		ENTR
01466		ENTR
XXX.XX		ENTR (Detent F EL data)
		ENTR
01467		ENTR
XXX.XX		ENTR (Detent R EL data)
		ENTR

6.3.15.3 AOT Measurement of XX

6.3.15.3.1 On K-148 enter:

VERB 57	ENTR
00012	ENTR

Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display.

6.3.15.3.2 On Computer Control and Reticle Dimming Assembly press MARK X pushbutton. Observe VERB 50 displayed on CRT DSKY display.

6.3.15.3.3 On DSKY press ENTR
Observe VERB 21 NOUN 30 flashing on DSKY

6.3.15.3.4 On DSKY enter:

00000 ENTR
Observe VERB 21 NOUN 43 flashing
00001 ENTR
Observe VERB 21 NOUN 42 flashing

6.3.15.3.5 Set AOT in L detent position.

6.3.15.3.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record as LY = XXX. XX.

6.3.15.3.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT dial indication as LS XXX. XX.

6.3.15.3.8 On DSKY enter:

±XXX. XX ENTR (LY from 6.3.15.3.6)
Observe VERB 22 NOUN 42 flashing
±XXX. XX ENTR (LS from 6.3.15.3.7)
Observe VERB 51 flashing and R1 = 00002.

6.3.15.3.9 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed.

6.3.15.3.10 On DSKY press ENTR
Observe VERB 21, NOUN 30 flashing on DSKY.

6.3.15.3.11 On DSKY enter:

00000 ENTR
Observe VERB 21, NOUN 43 flashing
00002 ENTR
Observe VERB 21, NOUN 42 flashing

6.3.15.3.12 Set AOT in F detent position.

6.3.15.3.13 Rotate AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Record AOT dial indication as FY = XXX. XX.

6.3.15.3.14 Rotate the AOT control knob until the center of the target reticle is superimposed between the double S reticle lines. Record AOT dial indication as FS = XXX. XX.

6.3.15.3.15 On DSKY enter:

±XXX. XX ENTR (FY from 6.3.15.3.13)
Observe VERB 22 NOUN 42 flashing
±XXX. XX ENTR (FS from 6.3.15.3.14)
Observe VERB 06 NOUN 03, R1 = X1±0.08 degrees.

6.3.15.4 AOT Measurement of X2

6.3.15.4.1 On K-148 enter

VERB 57 ENTR
00012 ENTR
Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display

6.3.15.4.2 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed on CRT DSKY display.

6.3.15.4.3 On DSKY press ENTR. Observe VERB 21 NOUN 30 flashing on DSKY.

6.3.15.4.4 On DSKY enter:

00000 ENTR
Observe VERB 21 NOUN 43 flashing
00001 ENTR
Observe VERB 21 NOUN 42 flashing
±XXX. XX ENTR (LY from 6.3.15.3.6)
Observe VERB 22 NOUN 42 flashing
±XXX. XX ENTR (LS from 6.3.15.3.7)
Observe VERB 51 flashing and R1 = 00002.

6.3.15.4.5 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed.

6.3.15.4.6 On DSKY press ENTR. Observe VERB 21, NOUN 30 flashing on DSKY.

APPENDIX I

MEASUREMENT TOLERANCES

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY 1% OF FULL SCALE
GG 1020 link 4*	+14 vdc LGC Supply	14.0±0.2 vdc	0%
GG 1030 link 4	+4 vdc LGC Supply	4.0±0.15 vdc	0%
GG 1040 link 5**	+120 vdc PIPA Supply	120±6.0 vdc	1%
GG 1070 link 4	+4 vdc CDU Supply	4.0±0.2 vdc	0%
GG 1100 link 4	-28 vdc Supply	-27.5±6.0 vdc	0%
GG 1110 link 5	2.5 vdc Telemetry Bias No. 1	2.5±0.1 vdc	0%
GG 1201 link 5	IMU 28V 800 cps 1%	28±0.56V rms	1%
GG 1202 link 4	IMU 28V 800 cps 5%	28±1.4V rms	1.5%
GG 1203 link 4	IMU 28V 800 cps 5%	28±2.1V rms	1.5%
GG 1331 link 5	3.2 kc 28V Supply 1%	28.6±0.56V rms	1%
GG 1500 link 4	+28 vdc IMU Oper BUS	28.0 -3.5, +5.5 vdc	0%
GG 1510 link 4	+28 vdc IMU STBY BUS	28.0 -3.5, +5.5 vdc	0%
GG 1513X link 5	+28 vdc IMU STBY/OFF	28.0±1 vdc	0%
GG 1520 link 4	+28 vdc LGC Oper BUS	28.0 +4.5, -3.5 vdc	0%
GG 1523X link 5	+28 vdc LGC Operate	28.0±1 vdc	0%
GG 2001 link 5	X PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2021 link 5	Y PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2041 link 5	Z PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2106 link 4	IG Servo Error Total	0.0±60 MV rms at null	1%
GG 2107 link 5	IG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2110 link 4	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2110 link 5	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2112 link 5	IG 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 2113 link 5	IG 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 2121 link 5	IG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2136 link 4	MG Servo Error Total	0.0±60 MV rms at null	1%
GG 2137 link 5	MG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2140 link 5	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2140 link 5	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2142 link 5	MG 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 2143 link 5	MG 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 2151 link 5	MG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2166 link 4	OG Servo Error Total	0.0±60 MV rms at null	1%
GG 2167 link 5	OG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2170 link 4	OG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%

APPENDIX I (Continued)

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY ±% OF FULL SCALE
GG 2170 link 5	OG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2172 link 5	OG 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 2173 link 5	OG 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 2181 link 5	OG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2219 link 5	Pitch Attitude Error	5.05±0.5V rms at 17°	1%
GG 2220 link 4	IG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2221 link 4	IG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2249 link 5	YAW Attitude Error	0.05±0.5V rms at 17°	1%
GG 2250 link 4	MG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2251 link 4	MG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2279 link 5	Roll Attitude Error	5.05±0.5V rms at null	1%
GG 2280 link 4	OG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2281 link 4	OG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2300 link 5	PIPA Temperature	130±2°F in Operate	1%
GG 2301 link 4	IRIG Temperature	135±2°F in Operate	1%
GG 2301 link 5	IRIG Temperature	135±2°F in Operate	1%
GG 2302 link 4	IMU Heater Current On	28±1 vdc	0%
GG 2303 link 4	IMU Blower Current On	28±1 vdc	0%
GG 3304 link 5	RR Shaft 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3305 link 5	RR Shaft 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 3311 link 4	RR Shaft CDU Fine Error	0.0±0.07V rms at null	1%
GG 3312 link 4	RR Shaft CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3321 link 4	RR Trunnion CDU Fine Error	0.0±0.07V rms at null	1%
GG 3322 link 4	RR Trunnion CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3324 link 5	RR Trunnion 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3325 link 5	RR Trunnion 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 4300 link 4	LGC Temperature	87.5±42.5°F	0%
GG 6020 link 4	PIPA Calibration Module Temperature	67.5±22.5°F	0%
GG 6020 link 5	PIPA Calibration Module Temperature	67.5±22.5°F	0%
GG 6021 link 4	PSA Temperature	85±25.0°F	0%

* Link 4 - PSAAM Output Signal

** Link 5 - SCA Output Signal

6.3.15.4.7 On DSKY enter:

00000 ENTR
Observe VERB 21 NOUN 43 flashing
00002 ENTR
Observe VERB 21 NOUN 42 flashing
±XXX.XX ENTR (RY from 6.3.15.1.6)
Observe VERB 22 NOUN 42 flashing
±XXX.XX ENTR (RS from 6.3.15.1.7)
Observe VERB 06 NOUN 03, R1 = X2±0.08 degrees.

ADDENDUM 1

LEM 1

ADDITION 1: The following procedure will be performed for LEM 1 only.

6.3.16 Gyrocompassing Test

6.3.16.1 Insure that the IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.16.2 On K-148 enter the following sequence:

VERB 57 ENTR
00006 ENTR

6.3.16.3 VERB 06 NOUN 61 shall flash.

6.3.16.4 The CRT, DSKY display shall display Launch Azimuth. (Launch Azimuth shall be the GAEC Navigator Base Azimuth defined by GAEC).

6.3.16.5 If value for Row 1 is correct, proceed to the next step. If value for Row 1 is incorrect, enter the following into K-148:

VERB 21 ENTR
±XXXXX ENTR Correct launch azimuth (GAEC Nav Base Az)

Verify value in Row 1 is correct.

6.3.16.6 On K-148 enter the following:

VERB 33 ENTR

6.3.16.7 VERB 06 NOUN 61 shall flash.

6.3.16.8 The CRT, DSKY display shall display Navigation Base Azimuth and Latitude, respectively.

6.3.16.9 If the values for Row 1 and Row 2 are correct, proceed to the next step. If the values for Row 1 or Row 2 are incorrect, enter the following into K-148.

If Row 1 is incorrect:	VERB 21	ENTR
	±XXXXX	ENTR (Correct Nav Base Azimuth)
If Row 2 is incorrect:	VERB 22	ENTR
	+40.748	ENTR (Correct Site Latitude)

Verify values for Row 1 and Row 2 are correct.

6.3.16.10 On K-148 enter the following:

VERB 33 ENTR
VERB 16 NOUN 20 ENTR

6.3.16.11 One hour after step 6.3.16.10 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.16.12 Obtain and record the latest measured value of the following data.

6.3.16.12.1 NBDX

6.3.16.12.2 NBDY

6.3.16.12.3 NBDZ

6.3.16.12.4 ADIAZ

6.3.16.12.5 ADSRAY

6.3.16.12.6 GAEC NB YZ plane about Z local vertical.

6.3.16.12.7 GAEC NB YZ plane about Y local vertical.

6.3.16.13 Calculate the vertical and east IRIG coefficient drift contribution to azimuth error (ϕ Vert).

a. Drift (vert) = NBDZ+ADIAZ = ________________ meru

b. Drift (east) = NBDX sin α +NBDY sin (α+ 90) + ADSRAY sin (α+ 90)
Where α = Launch Azimuth

c. ϕ vert = $\frac{32a + 272b}{3600}$ = ____________ degrees

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6.3.16.14 Algebraically subtract ϕ (vert) from the Row 1 DSKY display recorded in 6.3.16.11. The resultant azimuth error shall be 000.00±000.57 degrees.

6.3.16.15 Algebraically subtract the value recorded in 6.3.16.12.6 from the Row 3 DSKY display recorded in 6.3.16.11. The resultant vertical error about Z local vertical shall be 000.00±000.06 degrees.

6.3.16.16 Algebraically subtract the value recorded in 6.3.16.12.7 from the Row 2 DSKY display recorded in 6.3.16.11. The resultant vertical error about Y local vertical shall be 000.00±000.06 degrees.

6.3.16.17 Two hours after 6.3.16.10 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.16.18 The CRT DSKY display of Row 1 shall be within 000.06 degrees of the value recorded in 6.3.16.11. The CRT DSKY display of Row 2 and Row 3 shall be within 000.03 degrees of the respective values recorded in 6.3.16.11.

6.3.16.19 On K-148 enter the following:

VERB 36		ENTR
VERB 40	NOUN 20	ENTR
+00000		ENTR
+00000		ENTR
+00000		ENTR

ADDENDUM 1

LEM 1

Addition 2: Perform LEM 1 test in accordance with the following Flowgram.

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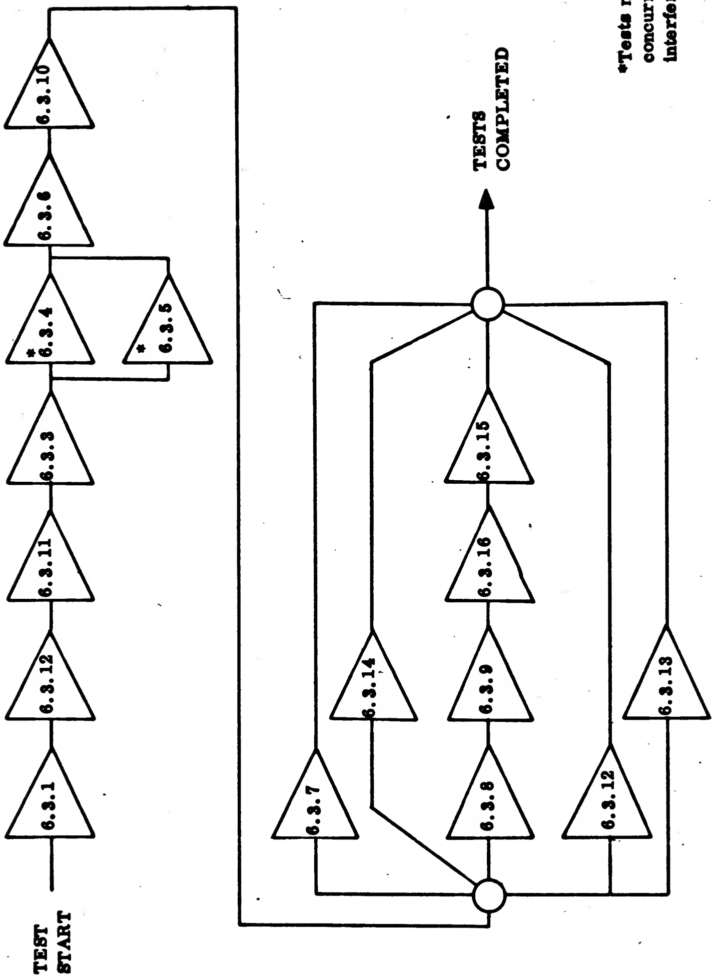


*Tests may be performed concurrently on a non-interference basis

TEST PROCEDURE FLOWGRAM

FIGURE 1

APOLLO G&N Specification
ND 1002323 REV B

Original Issue Date:
Release Authority: TDRR 31026
Class A Release

POST-INSTALLATION CHECKOUT SPECIFICATION
FOR LEM GUIDANCE AND NAVIGATION SYSTEM

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	APPROVALS	
				AC	NASA
11/23/66	A	32056	1-83 Was 83 pages, now 80 pages.	EA	WLS
12/29/66	B	32480	6-46, 51, 62, 67, 73, 74, 78	JP	- -

This specification consists of page 1 to 80 inclusive.

APPROVALS	NASA/MSC			9/13/66 ACED

uncertainties. All uncertainties due to instrumentation shall be root sum squared with the basic G&N tolerances to yield an acceptable tolerance for use when testing the G&N system in the spacecraft.

5.3.2 In the event of a conflict between requirements, the following order of precedence shall apply. The contractor shall also notify AC Electronics Site Manager of the conflict.

a. The contract
b. This specification
c. Documents referenced in this specification

5.4 TEST SEQUENCE

5.4.1 The test sequence shall normally follow the flow gram in Figure 1. Any test subsequent to Temperature Control Verification Section 6.3.4 may be conducted providing the General Turn On Procedure 6.2.4 is followed.

5.5 The generation of a noise alarm indication, as evidenced by one or more Noise Peak Event lamps becoming lighted shall be cause for immediate determination of effects on the G&N system test in progress. In the event of detrimental effects on the system test a troubleshooting routine shall be entered to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.

5.6 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N System as non-conforming. Normal test sequence may be continued upon determination of the cause of the nonconformance or at the discretion of the G&N contractor test team if it is determined that such action is not detrimental to the G&N System or other interfacing subsystems. All nonconformances shall be investigated and cleared by waivers (F.N.N.), correction of specification, or hardware replacement and retest. The suspected malfunctioned hardware shall be removed and returned to the laboratory where the malfunction shall be verified. Only after malfunction verification shall a flight certified replaceable element be installed in the G&N System.

5.7 After the defective replaceable element has been substituted with a flight certified unit, the G&N System checkout sequence shall regress to the rerunning of applicable portions of the selected sequence (by paragraph numbers) categorized by the subassemblies in which the malfunction occurred. The chosen subassembly categories are presented in Table A versus an appropriate retest paragraph sequence as a guide for applicable portions of indicated paragraph numbers in the sequence listed as indicated under the appropriate subassembly heading or as directed by NASA Test Engineering. Retest shall proceed to the point in the normal test sequence at which the discrepancy was detected and corrected. Normal testing shall continue beyond this point in the specified sequence of Figure 1.

5.8 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps pertaining directly to the G&N components. If any questions arise concerning the test equipment, the Test Conductor should refer to the respective operational manuals.

5.9 Spacecraft systems other than the G&N System may be operating on a noninterfering basis while individual system checkout of the G&N is being conducted.

TABLE A

RETEST SEQUENCE

Paragraph Number	Test Title	LGC	IMU	PSA	CDU	PTA	DSKY	A Harness	B Harness	Computer Control and Reticle Dimmer	Nav Base	Alignment Optical Telescope	Signal Conditioner
6.3.1	Standby Power On Test	X	X	X			X	X	X		X		
6.3.2	Alarms and Interrupts Test	X					X	X					
6.3.3	IMU Operate Power On Test		X	X	X	X		X	X		X		X
6.3.4	Temperature Control Verification		X	X				X	X		X		X
6.3.5	PGNCS Power Supply Test			X	X	X		X	X		X		X
6.3.6	IMU Operational Test	X	X	X	X	X		X	X		X		
6.3.7	PGNCS Operational Test		X	X	X			X	X		X		X
6.3.8	IRIG Scale Factor Test		X	X		X		X	X		X		
6.3.9	IMU Performance Test		X	X		X		X	X		X		
6.3.10	LGC Voltage Margin Test	X						X					
6.3.11	LGC Clock Frequency Test	X						X		X			
6.3.12	Gimbal Friction Test		X	X				X	X		X		X
6.3.13	Stabilization Loop Response Test		X	X		X		X	X		X		
6.3.14	G&N Fine Alignment Test		X	X	X			X	X		X	X	
6.3.15	AOT Functional Performance Test											X	
6.2.1	Emergency Shutdown Procedure	*	*	*	*	*	*	*	*	*	*	*	*
6.2.2	Normal Shutdown Procedure	*	*	*	*	*	*	*	*	*	*	*	*
6.2.3	Initial Turn-On Procedure	*	*	*	*	*	*	*	*	*	*	*	*
6.2.4	General Turn-On Procedure	*	*	*	*	*	*	*	*	*	*	*	*

*To be used as necessary to turn system on or off

Paragraph No.	Test Title
6.3.1	Standby Power In Test
6.3.2	Alarms and Interrupts Test
6.3.3	IMU Operate Power On Test
6.3.4	Temperature Control Verification
6.3.5	PGNCS Power Supply Test
6.3.6	IMU Operational Test
6.3.7	PGNCS Operational Test
6.3.8	IRIG Scale Factor Test
6.3.9	IMU Performance Test
6.3.10	LGC Voltage Margin Test
6.3.11	LGC Clock Frequency Test
6.3.12	Gimbal Friction Test
6.3.13	Stabilization Loop Response Test
6.3.14	G&N Fine Alignment Test
6.3.15	AOT Functional Performance Test

TEST SEQUENCE

FIGURE 1

5.10 DATA RETRIEVAL

5.10.1 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance reading shall be recorded and flagged by appropriate signals.

5.10.2 During G&N system testing, all interleaved data, Uplink Command Files and Downlink Data File shall be maintained (recorders On). All A/B PCM data that is not made available to the ACE displays shall be verified by requesting a time history data strip out of said data for the time period when the test was performed.

6. DETAILED REQUIREMENTS

6.1 INITIAL TEST CONDITIONS

6.1.1 The IMU shall be supplied with heater power on a continuous basis. The Portable Temperature Controller (Model No. 410-31058) shall be connected at all times although heater power may be supplied from the +28 VDC IMU STANDBY bus and monitored through ACE.

6.1.2 The IMU shall never be without heater power longer than 15 minutes.

6.2 OPERATIONAL REQUIREMENTS

NOTE: In the event that an Electrical Power Subsystem (EPS) Shutdown occurs for any reason while the G&N System is in the Operate Mode, turn off the +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Do not turn the +28 VDC IMU OPERATE circuit breaker on for a minimum of 5 minutes after the EPS shutdown occurs. Failure to observe this requirement can result in shifts of the critical Inertial Component parameters.

6.2.1 Emergency Shutdown Procedure

CAUTION

In the event of any malfunction which might damage the G&N System before the normal shutdown procedure in 6.2.2 can be performed, power shall be removed from the G&N System as soon as possible. If at all possible, without creating any delay, IMU Operate power should be removed first.

6.2.2 Normal Shutdown Procedure

6.2.2.1 The normal shutdown of a G&N System shall include parking the gimbals prior to removing IMU Operate Power. This is accomplished in the following procedure.

6.2.2.2 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+09000 ENTR

6.2.2.3 On the CRT, verify the following gimbal angles are displayed:

IG is between 358 and 002
MG is between 088 and 092
OG is between 358 and 002
Verify Gimbal Lock Lamp is lighted.

6.2.2.4 Pull out +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11 to remove IMU OPERATE power.

6.2.2.5 Pull out +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11 to remove LGC OPERATE power.

6.2.2.6 Pull out +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11 to remove IMU STANDBY power.

6.2.3 Initial Turn-On Procedure

6.2.3.1 Proper coolant flow shall be verified prior to application of any power to the G&N System.

6.2.3.2 The initial power turn-on sequence shall be in the order specified in the test procedures (6.3) observing all cautions and delays as specified.

6.2.4 General Turn-On Procedure

6.2.4.1 This step shall be effective only after having completed the initital turn-on procedures.

6.2.4.2 Proper coolant flow shall be verified.

6.2.4.3 Depress +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11 to supply IMU STANDBY power. Record time.

6.2.4.4 Depress +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11 to supply LGC Operate power.

6.2.4.5 Depress STBY pushbutton on DSKY for 3 seconds and verify STBY light on DSKY is off.

6.2.4.6 On K-148 enter the following sequence:

ERROR RESET
VERB 36 ENTR (fresh start)
VERB 57 ENTR
00015 ENTR (clear erasable memory)
VERB 21 NOUN 27 ENTR
77777 ENTR (LGC Self Check)

6.2.4.7 On the CRT, verify that the 3.2KC 28V Supply indicates between 28.04 and 29.16 VRMS (CG 1331).

6.2.4.8 On the CRT, verify that R1 does not display 01102 or 41102 (indicating a malfunction).

6.2.4.9 After 5 minutes, stop LGC Self Check by entering the following in K-148:

VERB 21 NOUN 27 ENTR
00000 ENTR

6.2.4.10 CAUTION: LGC OPERATE AND IMU STANDBY power must have been applied a minimum of two hours before energizing the IMU OPERATE circuit breaker in step 6.2.4.16 unless all of the following conditions are met:

IF: 1. The G&N System has previously been in Standby Mode at least two hours and subsequently been in Operate Mode, AND

2. The gimbals were placed in a parked position prior to shutdown, AND

3. The shutdown period did not exceed 5 days, AND

4. The Spacecraft or IMU have not been moved in any way during the shutdown period.

THEN: The two-hour standby Mode operation requirement is reduced to 15 minutes.

6.2.4.11 The G&N System is defined as being in Standby Mode when LGC Operate and IMU Standby power is applied and IMU Operate power is off. The inertial components shall have suspension power in Standby Mode.

6.2.4.12 The G&N System is defined as being in Operate Mode when LGC OPERATE, IMU STANDBY and IMU Operate Power is applied to the system.

6.2.4.13 Set up analog recorder to monitor the following signals:

	Signal No.	Signal Name
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 CPS

6.2.4.14 Start the analog recorder at a chart speed of 5 mm/sec. Start event recorder at a chart speed of 1 mm/sec.

6.2.4.15 On CRT, monitor +120 VDC PIPA SUPPLY (GG1040) and IMU gimbal angles. Record time. If 15 minutes have elapsed since performing Paragraph 6.2.4.3, proceed to the next paragraph.

6.2.4.16 Press in +28VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.2.4.17 Verify on analog recorder that the oscillations of the resolver sine signals (GG2112, GG2172 and GG2142) are not sustained and that the signals damp out within 15 seconds. If this condition is not attained, remove IMU OPERATE power immediately.

6.2.4.18 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.2.4.16 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.2.4.16.

6.2.4.19 Verify absence of LGC WARNING, ISS WARNING, and PGNCS CAUTION lights in the LEM cabin.

6.2.4.20 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.2.4.21 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.2.4.22 On the CRT, scan the power supply voltages to verify their normal operation. (No indications flashing).

6.2.4.23 After all the tests of 6.3 in Figure 1 have been completed, the General Turn-On Procedure (6.2.4) and IMU Operational Test (6.3.6) shall be completed before re-running any test. Otherwise, the testing sequence shall continue in accordance with Figure 2.

6.2.5 Interruption of Power

6.2.5.1 IMU Operate power shall never be applied without the presence of LGC Operate and IMU Standby Power.

6.2.5.2 The G&N System log book shall include the gimbal positions at time of power shutdown. If omitted, it shall be assumed that the gimbals were not parked prior to shutdown. The logbook shall also state if any movement of the IMU or Spacecraft has taken place after shutdown. The times of application and removal of any bus power to the G&N System shall be recorded.

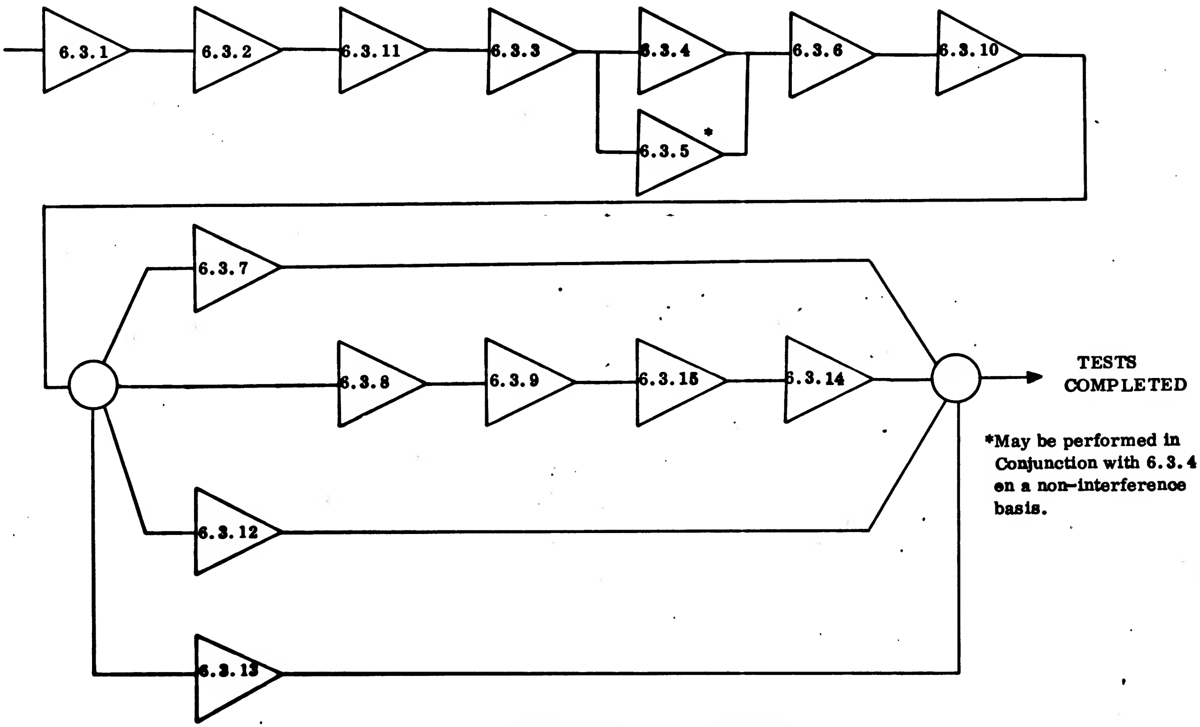
6.2.6 A warmup period of at least one hour in Operate mode is required prior to performing any test in which gyro or accelerometer parameters are measured, and at least 15 minutes prior to any test in which precision amplitude and frequency power supply checks are made.

6.3 TEST PROCEDURES

6.3.1 Standby Power On Tests

6.3.1.1 The Portable Temperature Controller, Model No. 400-31058 shall be supplying inertial component heater power to the G&N System through connector 56J1 (P230). If alarm or fail indications are present on the PTC, they shall be cleared by depressing the SYSTEM RESET pushbutton on the PTC.

6.3.1.2 Verify that spacecraft power checks, including both polarity as well as magnitude on the spacecraft power connectors, have been accomplished.



*May be performed in Conjunction with 6.3.4 on a non-interference basis.

TEST PROCEDURE FLOWGRAM

FIGURE 2

6.3.1.3 The following switches and/or circuit breakers shall be closed to energize the indicated buses.

LOCATION	NOMENCLATURE	IDENTIFICATION
Panel 14	BAT 5 NORMAL FEED	4S10
Panel 14	BAT 6 NORMAL FEED	4S11
Panel 16	X LUNAR BUS TIE	4CB5
Panel 16	BAT 1-4-6 FEED TIE	4CB17
Panel 16	BAT 2-3-5 FEED TIE	4CB25
Panel 16	ASC ECA	4CB14
Panel 16	ASC ECA CONT.	5CB7
Panel 16	DC BUS VOLT	4CB21
Panel 16	DISP.	4CB16
Panel 11	X LUNAR BUS TIE	4CB4
Panel 11	BAT 1-4-6 FEED TIE	4CB18
Panel 11	BAT 2-3-5 FEED TIE	4CB26
Panel 11	ASC ECA	4CB15
Panel 11	ASC ECA CONT.	4CB6
Panel 11	DC BUS VOLT	4CB22
Panel 16	INV. NO. 2	4CB13
Panel 14	AC PWR to INV 2 Position	4S14
Panel 11	AC BUS FEED TIE	4CB24
Panel 11	AC BUS VOLT	4CB27

6.3.1.4 IMU Standby Power Turn On

6.3.1.4.1 Turn on Event Recorder at a speed of .1 mm/sec. (1/10 mm/sec.).

6.3.1.4.2 Press in +28VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11. Record time.

6.3.1.4.3 Verify on event recorder that +28 VDC IMU STANDBY power discrete (GG 1513) is on. On CRT, +28V IMU STANDBY Bus (GG 1510) shall indicate between 24.5 and 33.5.

6.3.1.4.4 On CRT, the 28V 3200 CPS SUPPLY (GG 1331) shall indicate between 28.04 and 29.16 VRMS. Record this value.

6.3.1.4.5 The PIPA TEMP displayed on CRT, shall be monitored periodically for one hour to ensure that the PIPA Temperature Control circuitry is operating to maintain a temperature of 130±5.0 DEG F. (GG 2300). Two hours after performing step 6.3.1.4.2 record PIPA TEMP.

6.3.1.5 Computer Power Turn On

6.3.1.5.1 Press in +28VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11.

6.3.1.5.2 Depress STBY pushbutton on DSKY for three seconds and verify STBY light on DSKY is OFF.

6.3.1.5.3 On CRT, +28V LGC Operate Bus (GG1520) shall indicate between (24.5 and 33.5). Ignore computer alarm indications. Using DSKY, enter VERB 36, then press RSET. All computer alarms shall clear.

6.3.1.5.4 On CRT, the +14VDC LGC SUPPLY (GG 1020) shall indicate between 13.8 and 14.2 VDC. Record this value.

6.3.1.5.5 On CRT, the +4 VDC LGC SUPPLY (GG 1030) shall indicate between 3.85 and 4.15 VDC. Record this value.

6.3.1.6 LGC Operational Tests

6.3.1.6.1 DSKY Check

6.3.1.6.1.1 Initiate the DSKY check by entering in the DSKY:

Press ERROR RESET
VERB 57 ENTR 00015 ENTR (clear erasable memory)
VERB 21 NOUN 27 ENTR
00011 ENTR

6.3.1.6.1.2 All the electroluminescent elements (PROG, VERB, NOUN, and Row 1, Row 2, Row 3) shall display the decimal number (9). Including the 9's, each of the following shall be displayed for approximately 5 seconds.

a. 9's
b. 8's
c. 7's
d. 6's
e. 5's
f. 4's
g. 3's
h. 2's
i. 1's
j. 0's
k. Minus signs in Row 1, ROW 2, ROW 3 } On concurrently for 5 seconds
l. VERB-NOUN Flashing }
m. COMP ACTY }

o. Plus signs in ROWS 1, 2, and 3 } On concurrently for 5 seconds
p. VERB-NOUN Flashing
q. COMP ACTY
r. COMP ACTY - On for 5 seconds then DSKY blanks.

6.3.1.6.1.3 The DSKY pushbuttons shall be checked by entering:

VERB 25 NOUN 01 ENTR
01740 ENTR
+00123 ENTR
-00456 ENTR
-00789 DO NOT press ENTR
The DSKY shall display +00123 in Row 1, -00456 in Row 2, and -00789 in Row 3. Press CLR pushbutton three times on DSKY. Observe that Row 1, Row 2, and Row 3 are blank.

6.3.1.6.2 Lamp Test

6.3.1.6.2.1 Initiate the Lamp Test by entering in the DSKY:

VERB 35 ENTR

6.3.1.6.2.2 The following DSKY displays shall illuminate for 5 seconds

a. UP LINK ACTY
b. NO ATT
c. STBY
d. KEY REL
e. TEMP
f. GIMBAL LOCK
g. PROG
h. RESTART
i. TRACKER
j. OPR ERROR Flashing
k. VERB-NOUN Flashing
l. Plus 88888 in Row 1, Row 2, and Row 3

} On concurrently for 5 seconds

6.3.1.6.3 Uplink Check

6.3.1.6.3.1 On K-START 148; set LOAD/INHIBIT switch to LOAD, set TAPE/KEY switch to KEY, then enter the following:

ERROR RESET
VERB 25 NOUN 01 ENTR
02400 ENTR
+01234 ENTR
-56789 ENTR
+00000 ENTR

6.3.1.6.3.2 Verify the following is displayed on the DSKY.

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.4 Downlink Check

6.3.1.6.4.1 On CRT, DSKY display, verify the following is displayed:

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.5 LGC Self-Check

6.3.1.6.5.1 On K-148; enter the following sequence to initiate the LGC Self-Check:

VERB 36 NOUN 27 ENTR ENTR
VERB 21 ENTR NOUN 27 ENTR
77777 15 NOUN 01 ENTR ENTR
VERB 15 ENTR NOUN 01 ENTR
01366 ENTR

6.3.1.6.5.2 On the CRT, DSKY display, verify that R1 does not display 01102 or 41102. If a malfunction occurs, the following is displayed:

R1 01102 or 41102
R2 XXXXX a (S FAIL) program address +1 of point of failure
R3 XXXXX number of fails

6.3.1.6.5.3 When R3 = 00002, stop the LGC Self Check by entering in K-148 the following:

VERB 34 ENTR
VERB 21 NOUN 27 ENTR
00000 ENTR

6.3.1.6.6 LGC Standby Check

6.3.1.6.6.1 On K-148 enter the following sequence:

VERB 21 NOUN 10 ENTR
00013 ENTR
02000 ENTR

6.3.1.6.6.2 On DSKY depress STBY pushbutton for approximately 3 seconds.

6.3.1.6.6.3 Verify STBY status indicator lamp is ON.

6.3.1.6.6.4 On the CRT, verify the 3.2KC 28V Supply (GG 1331) is between 28.04 and 29.16V RMS.

6.3.1.6.6.5 On DSKY depress STBY pushbutton for approximately 3 seconds to return to LGC OPERATE mode.

6.3.1.6.6.6 Verify STBY status indicator lamp is OFF.

6.3.2 Alarms and Interrupts Test

6.3.2.1 Parity Fail Test

6.3.2.1.1 On K-148 enter the following sequence

VERB 21 NOUN 02 ENTR
01600 ENTR
33777 ENTR

6.3.2.1.2 On CRT, DSKY display, verify R1 = 33777 and R3 = 01600

6.3.2.1.3 On K-148 enter the following sequence

VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.1.4 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.1.5 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.2 Rupt Lock-Interrupt Too Long

6.3.2.2.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
00001 ENTR
01600 ENTR
00003 ENTR
VERB 31 ENTR

6.3.2.2.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.2.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.3 TC Trap Test

6.3.2.3.1 On K-148 enter the following sequence

VERB 21 NOUN 01 ENTR
01600 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.3.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.3.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.4 Nightwatchman Test

6.3.2.4.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
03400 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.4.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.4.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.3 IMU OPERATE POWER ON TESTS

CAUTION

Prior to application of IMU OPERATE power in step 6.3.3.1.4, LGC OPERATE and IMU STANDBY power must have been applied to the G&N System continuously for a minimum of two hours. The only exception is when the requirements of step 6.2.4.10 are met and this does not apply for the initial application of IMU OPERATE power.

6.3.3.1 Verification of Power Turn-On

6.3.3.1.1 Set up analog recorder to monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps
h.	SPARE	

6.3.3.1.2 Start analog recorder to a chart speed of 5 mm/sec. Start event recorder at a chart speed of .1 mm/sec.. ([illegible]).

6.3.3.1.3 On CRT, monitor +120 VDC PIPA SUPPLY (GG1040) and IMU gimbal angles.

6.3.3.1.4 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.3.3.1.5 Verify on analog recorder that the oscillations of the resolver sine signals (GG2112, GG2172, and GG2142) are not sustained and that the signals damp out within 15 seconds. If they don't, remove IMU OPERATE power as soon as possible.

6.3.3.1.6 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.3.3.1.4 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.3.3.1.4.

6.3.3.1.7 On event recorder verify the following:

LGC WARNING is OFF (GG9001)
ISS WARNING is OFF (GG9002)
PGNCS CAUTION is OFF (GG9003)

6.3.3.1.8 On CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.3.1.9 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.4 Temperature Control Verification

6.3.4.1 When 15 minutes have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP (GG2300).

6.3.4.2 When 30 minutes have elapsed from the time of IMU OPERATE power turn-on record IRIG TEMP (GG2301).

6.3.4.3 When 1 hour has elapsed from the time of IMU OPERATE power turn-on, monitor PIPA TEMP (GG2300) and IRIG TEMP (GG2301) on the CRT. Monitor and record temperature readings every 5 minutes for one hour. Verify that each reading does not deviate from the average value of each signal by more than 0.1°F.

6.3.4.4 When 2 hours have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP and IRIG TEMP. The PIPA Temp shall be 130.5 (±1.5)°F. The IRIG TEMP shall be 135 (±2.5°)F.

6.3.4.5 The PIPA TEMP recorded in step 6.3.4.4 shall be within 0.5°F of temperature recorded in steps 6.3.1.5.5 and 6.3.4.1.

6.3.4.6 The IRIG TEMP recorded in step 6.3.4.4 shall be within 0.5°F of the temperature recorded in step 6.3.4.2.

6.3.5 PGNCS Power Supply Tests

6.3.5.1 From the CRT, confirm power supply voltages (or temperatures) are as specified and record values observed.

6.3.5.2 The PIPA Calibration Module Temperature (GG6020) shall be between +45 and +90 DEG F.

6.3.5.3 The PSA Temperature (GG6021) shall be between +60 and +110 DEG F.

6.3.5.4 The LGC Temperature (GG4300) shall be between +45 and +130 DEG. F.

6.3.5.5 The +28 VDC IMU OPERATE BUS (GG1500) shall be between 24.5 and 33.5 VDC.

6.3.5.6 The +28 VDC IMU STANDBY BUS (GG1510) shall be between 24.5 and 33.5 VDC.

6.3.5.7 The +28 VDC LGC OPERATE BUS (GG1520) shall be between 24.5 and 33.5 VDC.

6.3.5.8 The +120 VDC PIPA Supply (GG1040) shall be between 114 and 126 VDC.

6.3.5.9 The -28VDC Supply (GG1100) shall be between -21.5 and -33.5 VDC.

6.3.5.10 The +4VDC CDU Supply (GG1070) shall be between 3.8 and 4.2 VDC.

6.3.5.11 The IMU 28V 800 CPS 1 pct Supply (GG1201) shall be between 27.44 and 28.56 VRMS.

6.3.5.12 The IMU 28V 800 CPS 5 pct 90 PH Supply (GG1202) shall be between 26.6 and 29.4 VRMS.

6.3.5.13 The IMU 28V 800 CPS 5 pct 0 PH Supply (GG1203) shall be between 25.9 and 30.1 VRMS.

6.3.5.14 The 3.2 KC 28V Supply (GG1331) shall be between 28.04 and 29.16 VRMS.

6.3.5.15 The 2.5 VDC T/M Bias (GG1110) shall be between 2.4 and 2.6 VDC.

6.3.5.16 The +14 VDC LGC Supply (GG1020) shall be between 13.8 and 14.2 VDC.

6.3.5.17 The +4 VDC LGC Supply (GG1030) shall be between 3.85 and 4.15 VDC.

6.3.6 IMU OPERATIONAL TEST

6.3.6.1 On K-148 enter the following:

VERB 01 NOUN 10 ENTR
00003 ENTR
Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.6.2 On K-148 enter the following:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 02 ENTR
01300 ENTR
Record CRT DSKY Row 1 indication as ±BBBBB

6.3.6.3 Perform the following calculations:

a. $\frac{\text{BBBBB} \times 5.12}{3600}$ = CCCC.C (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours

d. DDDD. D + time of day recorded in 6.3.6.1 = time of day at which high order scalar register will overflow.

6.3.6.4 If time of day is within 12 minutes of that calculated in 6.3.6.3.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.6.3.c has passed and proceed.

6.3.6.5 In K-148 enter the following sequence:

VERB 57 ENTR
00004 ENTR

6.3.6.6 Wait 200 seconds, then verify on the CRT, that the X, Y and Z PIPA SG Output signals all indicate 0.0±2.5 Volts but not 0.

6.3.6.7 Approximately 12 minutes after performing step 6.3.6.1, VERB 06 NOUN 66 shall flash.

6.3.6.8 From the CRT, DSKY display, read and record R1 and R2 (local gravity whole and fractional respectively). The value recorded shall be between 975.0 and 985.9 cm/sec^2.

6.3.6.9 On K-148 enter the following sequence

VERB 33 ENTR
VERB 06 NOUN 66 shall flash.

6.3.6.10 From the CRT, DSKY display, read and record the horizontal fractional component of earth rate acting on the X, Y, and Z IRIG's as displayed in R2. The value recorded shall be between .65750 and .85750.

6.3.6.11 Terminate the test by entering in K-148 the following:

VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.7 PGNCS Operational Test

6.3.7.1 Start the PGNCS Operational test by inserting the following sequence into K-148:

VERB 57 ENTR
00010 ENTR
Program 07 shall be displayed
VERB 33 NOUN 01 is displayed flashing

6.3.7.2 Command Accuracy 0°

6.3.7.2.1 On K-148, press ENTR

VERB 33 NOUN 02 is displayed flashing
Press ENTR
VERB 33 NOUN 03 is displayed flashing

6.3.7.2.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 000±001 degrees.

6.3.7.2.3 Read and record CRT the DSKY Row 1, 2, and 3 indications. The indications shall be +00000 ± 00007.

6.3.7.3 Command Accuracy 45°.

6.3.7.3.1 On K-148, press ENTR, VERB 33 NOUN 04 is displayed flashing after approximately 20 seconds.

6.3.7.3.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 045±001 degrees.

6.3.7.3.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +04500 ± 00007.

6.3.7.4 CDU Repeating Accuracy 45°

6.3.7.4.1 On K-148 press ENTR. In about 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.4.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.5 Command Accuracy 90°

6.3.7.5.1 On K-148 Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 06 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.5.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 090±001 degrees.

6.3.7.5.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be +09000 ± 00007.

6.3.7.6 Command Accuracy 135°

6.3.7.6.1 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 07 is displayed flashing.

6.3.7.6.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 135±001 degrees.

6.3.7.6.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +13500 ± 00007.

6.3.7.7 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 10 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.8 CDU Repeating Accuracy 135°.

6.3.7.8.1 On K-148 press ENTR pushbutton. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.8.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.9 + Gimbal Lock Test

6.3.7.9.1 On K-148, Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 12 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.10 Command Accuracy 225°

6.3.7.10.1 On K-148 press ENTR. In approximately 20 seconds, VERB 33, NOUN 13 is displayed flashing.

6.3.7.10.2 Read and record the CRT indication of IMU gimbal angles. The indication shall be 225±001 degrees.

6.3.7.10.3 Read and record CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +225 ± 00007.

6.3.7.11 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 14 is displayed. The GIMBAL LOCK lamp shall not be lighted.

6.3.7.12 CDU Command Rate Test

6.3.7.12.1 On K-148 press ENTR. In approximately 30 seconds VERB 06 NOUN 66 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.12.2 Read and record the CRT DSKY Row 1, 2, and 3 indications. The indication shall be between 00012 and 00016.

6.3.7.12.3 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.12.4 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on the DSKY shall not be lighted.

6.3.7.13 Command Accuracy 315°.

6.3.7.13.1 On K-148 insert VERB 33 ENTR. In approximately 20 seconds VERB 33 NOUN 20 will be displayed flashing.

6.3.7.13.2 Read and record CRT indication of IMU gimbal angles. The indications shall be 315±001 degrees.

6.3.7.13.3 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indications shall be +315 ± 00007.

6.3.7.14 CDU Repeating Accuracy 315°

6.3.7.14.1 On K-148 press ENTR. In approximately 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.14.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.15 -Gimbal Lock Test

6.3.7.15.1 On K-148 Press VERB 33 ENTR. In approximately 20 seconds VERB 33, NOUN 22 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.16 CDU Repeating Accuracy 225°

6.3.7.16.1 On K-148, press ENTR. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.16.2 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indication shall be between 77774 and 00003.

6.3.7.17 On K-148 Press VERB 33 ENTR. The GIMBAL LOCK lamp shall not be lighted. VERB 21, NOUN 22 is displayed flashing.

6.3.7.18 IMU CDU Fine Fail Test

6.3.7.18.1 On K-148 insert the following sequence

+00100 ENTR
+00100 ENTR
+00100 ENTR
On Event Module verify that ISS WARNING lamp lights.

6.3.7.18.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display Row 1 indicates 33XXX or 32XXX.

6.3.7.19 IMU CDU Coarse Fail Test

6.3.7.19.1 On K-148 insert the following sequence

VERB 33 ENTR
+03750 ENTR
+03750 ENTR
+03750 ENTR
Verify that ISS WARNING lamp Event Module lights.

6.3.7.19.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display of Row 1 indicates 33XXX or 32XXX.

6.3.7.20 FDAI Linearity Test

6.3.7.20.1 On K-148 enter VERB 33 ENTR
VERB 33 NOUN 27 shall be displayed.

6.3.7.20.2 On CRT verify the following:

PITCH ATT ERROR is between +15.3 and +18.7 DEG (GG2219)
YAW ATT ERROR is between +15.3 and +18.7 DEG (GG2249)
ROLL ATT ERROR is between +15.3 and +18.7 DEG (GG2279)

6.3.7.20.3 On K-148 press ENTR.
VERB 33 NOUN 30 shall be displayed.

6.3.7.20.4 On CRT verify the following:

PITCH ATT ERROR is between +14.4 and +17.6 DEG (GG2219)
YAW ATT ERROR is between +14.4 and +17.6 DEG (GG2249)
ROLL ATT ERROR is between +14.4 and +17.6 DEG (GG2279)

6.3.7.20.5 On K-148 press ENTR.
VERB 33 NOUN 31 shall be displayed

6.3.7.20.6 On CRT verify the following:

PITCH ATT ERROR is between +05.4 and +06.6 DEG (GG2219)
YAW ATT ERROR is between +05.4 and +06.6 DEG (GG2249)
ROLL ATT ERROR is between +05.4 and +06.6 DEG (GG2279)

6.3.7.20.7 On K-148 press ENTR.
VERB 33 NOUN 32 shall be displayed.

6.3.7.20.8 On CRT verify the following:

PITCH ATT ERROR is between +00.2 and -00.2 DEG (GG2219)
YAW ATT ERROR is between +00.2 and -00.2 DEG (GG2249)
ROLL ATT ERROR is between +00.2 and -00.2 DEG (GG2279)

6.3.7.20.9 On K-148 press ENTR.

VERB 33 NOUN 33 shall be displayed.

6.3.7.20.10 On CRT verify the following:

PITCH ATT ERROR is between -05.4 and -06.6 DEG (GG2219)
YAW ATT ERROR is between -05.4 and -06.6 DEG (GG2249)
ROLL ATT ERROR is between -05.4 and -06.6 DEG (GG2279)

6.3.7.20.11 On K-148 press ENTR.
VERB 33 NOUN 34 shall be displayed.

6.3.7.20.12 On CRT verify the following:

PITCH ATT ERROR is between -14.4 and -17.6 DEG (GG2219)
YAW ATT ERROR is between -14.4 and -17.6 DEG (GC2249)
ROLL ATT ERROR is between -14.4 and -17.6 DEG (GG2279)

6.3.7.20.13 On K-148 press ENTR.
VERB 33 NOUN 35 shall be displayed.

6.3.7.20.14 On CRT verify the following:

PITCH ATT ERROR is between -15.3 and -18.7 DEG (GG2219)
YAW ATT ERROR is between -15.3 and -18.7 DEG (GG2249)
ROLL ATT ERROR is between -15.3 and -18.7 DEG (GG2279)

6.3.7.21 On K-148 enter VERB 36 ENTR.
The proper operation of the IMU CAGE function (consisting of steps 6.3.7.21 thru 6.3.7.23) need be performed only once during the initial PGNCS Operational Test and omitted from subsequent testing of test 6.3.7.

6.3.7.21.1 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00500 ENTR
+00500 ENTR
+00500 ENTR

6.3.7.21.2 On the CRT, verify all IMU gimbal angles indicate between 003 and 007 DEG.

6.3.7.21.3 On analog recorder, monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps

6.3.7.21.4 Start analog recorder to a chart speed of 5 mm/sec.

6.3.7.21.5 On LEM Cabin Panel 4, hold IMU CAGE momentary toggle switch in the ON position. (Do not release).

6.3.7.21.6 On analog recorder, verify the 1X Resolver Sine signals (GG2112, GG2172, GG2142) null out to less than 0.5 VRMS. Release IMU CAGE switch to the OFF position. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Any sustained oscillations shall be cause for immediate removal of IMU Operate power.

6.3.7.21.7 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.7.22 Stop analog recorder.

6.3.7.23 On K-148 enter the following sequence:

VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00700 ENTR
+00700 ENTR
+00700 ENTR

6.3.7.24 On CRT verify the following I
IG 1X Resolver Sin (11°) is between +05.0 and 09.0 DEG (GG2121)
MG 1X Resolver Sin (11°) is between +05.0 and 09.0 DEG (GG2151)
OG 1X Resolver Sin (11°) is between +05.0 and 09.0 DEG (GG2181)

6.3.7.25 On K-148 enter the following:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.8 IRIG Scale Factor Determination

6.3.8.1 Insure that the IMU Operate power and LGC Operate power have been applied for a minimum of one hour and that the IMU is not in a gimbal lock condition.

6.3.8.2 On meter module monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.8.3 On K-148 enter the following sequence:

VERB 57 ENTR
00005 ENTR

6.3.8.4 PROG 07 shall be displayed.

6.3.8.5 VERB 06 NOUN 61 shall flash.

6.3.8.6 On the CRT DSKY, Verify contents of Row 1 (Navigation Base azimuth) and Row 2 (Site latitude shall be displayed).

6.3.8.7 If values for Row 1 and Row 2 are correct, proceed to the next step.
If values for Row 1 and Row 2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR
±xxxxx ENTR (Correct navigation base azimuth)
40.748 ENTR (Correct site latitude)
Verify values in Row 1 and Row 2 are correct.

6.3.8.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.8.

6.3.8.9 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (-X IRIG Scale Factor error in part per million, Position +00001)

6.3.8.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.10.

6.3.8.11 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (-Y IRIG Scale Factor error in parts per million, Position +00002).

6.3.8.12 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.12.

6.3.8.13 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position +00003).

6.3.8.14 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.14.

6.3.8.15 In approximately 200 seconds, VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row (+X IRIG Scale Factor error in parts per million, Position -00001).

6.3.8.16 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.16.

6.3.8.17 In approximately 200 seconds, VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor error in parts per million, Position -00002).

6.3.8.18 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM is ON, enter VERB 36 ENTR and repeat steps, 6.3.8.3 through 6.3.8.7 and 6.3.8.18.

6.3.8.19 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (-Z IRIG Scale Factor error in parts per million, Position -00003).

6.3.8.20 Repeat steps 6.3.8.8 through 6.3.8.19 twice to obtain second and third set of data.

6.3.8.21 Terminate this test by entering in K-148 the following:

VERB 34 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.8.22 The average of the three readings of Scale Factor Error for each of the 6 positions shall be 0 ± 1750 PPM.

6.3.9 IMU Performance Test. A reference data sheet is provided at the end of this section to aid in data reduction. Table I of the data sheet should be completed before the start of this test.

6.3.9.1 Insure that IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.9.2 On CRT display, monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.9.3 Adjust oscilloscope to display butterfly of X PIPA.

6.3.9.4 On K-148 enter the following:

VERB 01 NOUN 10 ENTR
00003 ENTR
Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.9.5 On K-148 enter the following:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 02 ENTR
01300 ENTR
Record CRT DSKY Row 1 indications as ±BBBBB.

6.3.9.6 Perform the following calculations:

a. $\frac{\text{BBBBB} \times 5.12}{360}$ = CCCC.C (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours.

c. DDDD.D + present time of day = time of day at which high order scalar register will overflow.

6.3.9.7 If the time of day is within 12 minutes of that calculated in 6.3.9.6.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.9.6.c has passed and proceed.

Paragraph

6.3.9.15
6.3.9.22
6.3.9.30
6.3.9.36
6.3.9.43
6.3.9.48

6.3.9.8 On K-148 enter the following sequence:

VERB 01	NOUN 01	ENTR
00370		ENTR
Record contents of CRT DSKY Row 1 XXXXY		
VERB 21	NOUN 01	ENTR
00370		ENTR
XXXXY'		ENTR
Where Y' is obtained from Table 1a.		
VERB 57		ENTR
00001		ENTR
VERB 06	NOUN 61 shall flash	

6.3.9.9 On the CRT, DSKY display verify R1 (Navigation Base Azimuth) and R2 (Site Latitude) are correct.

6.3.9.10 If values for R1 and R2 are correct, proceed to next step.
If values for R1 and R2 are incorrect, enter the following sequence into K-148.

VERB 24 ENTR
±xxx.xx ENTR (Correct navigation base azimuth ±0.50 deg)
+40.748 ENTR (Correct site latitude)
Verify values in R1 and R2 are correct.

6.3.9.11 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.12 On CRT, DSKY display, verify R1 = +00600 (Time), R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position). If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00600 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00001 ENTR (Test Position Entry)

6.3.9.13 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.14 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 (+NBDY Position +00001).

6.3.9.15 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.16 After 100 seconds, take a photograph of Y and Z PIPA butterfly patterns on oscilloscope.

6.3.9.17 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (+X PIPA Position +00001). Row 1 is whole part, Row 2 is fractional part. Units are cm/sec^2.

6.3.9.18 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.19 On CRT, DSKY display - verify R1 = +00600, R2 = +00000, and R3 = +00002.

6.3.9.20 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.21 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDZ Position +00002).

6.3.9.22 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.23 Approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (-X PIPA Position +00002).

6.3.9.24 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.25 In approximately 67 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX + ADIAX Pos +00002).

6.3.9.26 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.27 On CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00003.

6.3.9.28 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.29 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX Position +00003).

6.3.9.30 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.31 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Z PIPA Position +00003).

6.3.9.32 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.33 On the CRT, DSKY display verify R1 = +00600, R2 = 00000, and R3 = +00004.

6.3.9.34 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.35 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDY + ADSRAY Position +00004).

6.3.9.36 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.37 After 100 seconds, take a photograph of the X-PIPA butterfly pattern on oscilloscope.

6.3.9.38 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (-Z PIPA Position +00004).

6.3.9.39 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.40 In approximately 67 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display record R2 (+NBDZ + ADIAZ Position +00004).

6.3.9.41 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.42 From the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00005.

6.3.9.43 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.44 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.45 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Y PIPA Position +00005).

6.3.9.46 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.47 On the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00006.

6.3.9.48 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.49 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.50 In approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2. (-Y PIPA Position +00006).

6.3.9.51 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.52 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000 and R3 = +00007.

6.3.9.53 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.54 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+.707 ADSRAX-NBDX Position +00007).

6.3.9.55 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.56 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00008.

6.3.9.57 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.58 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 [-.707 (NBDZ+NBDY) +0.5 (ADIAZ - ADIAY) +0.5 (ADSRAY + ADSRAZ)] (Position + 00008).

6.3.9.59 On K-148 enter the following:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.60 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00009.

6.3.9.61 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.62 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display, record R2 (-NBDZ + .707 ADSRAZ Position +00009).

6.3.9.63 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.64 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00010.

6.3.9.65 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.66 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 [.707 (NBDY-NBDX) +.5 (ADIAY - ADIAX) +.5 ADSRAX] (Position +00010).

6.3.9.67 Terminate this test by entering in K-148 the following:

VERB 36 ENTR

6.3.9.68 On CRT, record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).

6.3.9.69 On K-148 enter the following sequence:
VERB 41 NOUN 20 ENTER
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.9.52 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000 and R3 = +00007.

6.3.9.53 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.54 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+.707 ADSRAX-NBDX Position +00007).

6.3.9.55 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.56 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00008.

6.3.9.57 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.58 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 [-.707 (NBDZ+NBDY) +0.5 (ADIAZ - ADIAY) +0.5 (ADSRAY + ADSRAZ)] (Position + 00008).

6.3.9.59 On K-148 enter the following:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.60 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00009.

6.3.9.61 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.62 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display, record R2 (-NBDZ + .707 ADSRAZ Position +00009).

6.3.9.63 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.64 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00010.

6.3.9.65 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.66 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 [.707 (NBDY-NBDX) +.5 (ADIAY - ADIAX) +.5 ADSRAX] (Position +00010).

6.3.9.67 Terminate this test by entering in K-148 the following:

VERB 36 ENTR

6.3.9.68 On CRT, record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).

6.3.9.69 On K-148 enter the following sequence:
VERB 41 NOUN 20 ENTER
+00000 ENTR
+00000 ENTR
+00000 ENTR

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9.14	+N BDY Position +00001	meru	( ) ---.--	a.
6.3.9.17	+X PIPA Test Position +00001	cm/sec^2	( ) 00---. ( )-----	b.
6.3.9.21	+ N BDZ Position +00002	meru	( ) ---.--	c.
6.3.9.23	-X PIPA Test Position +00002	cm/sec^2	( ) 00---. ( )-----	d.
6.3.9.25	-N BDX + ADIAX Position +00002	meru	( ) ---, --	e.
6.3.9.29	-N BDX Position +00003	meru	( ) ---.--	f.
6.3.9.31	+Z PIPA Test Position +00003	cm/sec^2	( ) 00---. ( ) -----	g.
6.3.9.35	+N BDY + ADSRAY Position +00004	meru	( ) ---.--	h.
6.3.9.38	-Z PIPA Test Position +00004	cm/sec^2	( ) 00---. ( ) -----	i.
6.3.9.40	+N BDZ + ADIAZ Position +00004	meru	( ) ---.--	j.
6.3.9.45	+Y PIPA Test Position +00005	cm/sec^2	( ) 00---. ( ) -----	k.
6.3.9.50	-Y PIPA Test Position +00006	cm/sec^2	( ) 00---. ( ) -----	l.

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9.54	-NBDX+ .707 ADSRAX Position +00007	meru		m.
6.3.9.58	-.707 (NBDZ+NBDY) +0.5 (ADIAZ-ADIAY) +0.5 (ADSRAY+ADSRAZ) Position +00008	meru		n.
6.3.9.62	-NBDZ+.707ADSRAZ Position +00009	meru		o.
6.3.9.66	.707(NBDY-NBDX) +.5 (ADIAY-ADIAX) +.5 ADSRAX Position +00010	meru		p.

DATA SHEET

CALCULATION	PARAMETER	UNITS	
line c - line f = ( ) ---.-- (-NBDX+ADIAX) - (-NBDX)	ADIAX	meru	q
line h - line a = ( ) ---.-- (+NBDY+ADSRAY) - (+NBDY)	ADSRAY	meru	r
line j - line c = ( )---.-- (+NBDZ+ADIAZ) - (NBDZ)	ADIAZ	meru	s
(line m - line f) X1.414 = ( ) ---.-- [(-NBDX + .707 ADSRAX) -(-NBDX)] X 1.414	ADSRAX	meru	t
(line o + line c) X1.414 = ( ) ---.-- (-NBDZ+.707 ADSRAZ + NBDZ) X1.414	ADSRAZ	meru	u
(line p - .707 line a -.707 line f +.5 line q -.5 line t) X2 = ---.-- [.707 (NBDY-NBDX) +.5 (ADIAY -ADIAX) +.5 ADSRAX -.707 (-NBDX) -.707 NBDY +.5 ADIAX -.5 ADSRAX] X2	ADIAY	meru	v
line b - line d = ( )	PIPA X2G	cm/sec^2	w
line k - line l = ( )	PIPA Y2G	cm/sec^2	x
line g - line i = ( )	PIPA Z2G	cm/sec^2	y
1960.52 - line w X 1 cm/sec/pulse Transfer results to line ay	X PIPA S.F.	cm/sec/ pulse	z
1960.52 - line x X 1cm/sec/pulse transfer results to line az	Y PIPA S.F.	cm/sec/ pulse	aa
1960.52 - line y X /cm/sec/pulse Transfer results to line ba	Z PIPA S.F.	cm/sec/ pulse	ab
1/2 (line b + line d) = ( ) --.--- Transfer results to line bb	X PIPA Bias	cm/sec^2	ac
1/2 (line k + line l) = ( ) --.--- Transfer results to line bc	Y PIPA Bias	cm/sec^2	ad
1/2 (line g + line i) = ( ) --.--- Transfer results to line bd	Z PIPA Bias	cm/sec^2	ae
Perform the following calculations for values of NBD, ADSRA and ADIA. The constants are obtained from Table I. Transfer results to items ap through ax on data sheet			af
Δ NBDY = line a - NBDY Δ NBDY =		meru	ag
Δ NBDZ = line c - NBDZ Δ NBDZ =		meru	ah
Δ NBDX = (-line f) - NBDX Δ NBDX =		meru	ai
Δ ADIAX = line q - ADIAX Δ ADIAX =		meru	aj
Δ ADSRAY = line r - ADSRAY Δ ADSRAY =		meru	ak
Δ ADIAZ = line s - ADIAZ Δ ADIAZ =		meru	al
Δ ADSRAX = line t - ADSRAX Δ ADSRAX =		meru	am

4

CALCULATION	PARAMETER	UNITS	
Δ ADSRAZ = line n - ADSRAZ Δ ADSRAZ =		meru	an
Δ ADIAY = line v - ADIAY Δ ADIAY =		meru	ao

DATA SHEET

PARAMETER	UNITS	MIN VALUE	RECORDED VALUE	MAX VALUE	REJ	ACC	
Δ NBDY	meru	-5.0		+5.0			ap
Δ NBDZ	meru	-5.0		+5.0			ag
Δ NBDX	meru	-5.0		+5.0			ar
Δ ADSRAY	meru	-10.0		+10.0			as
Δ ADSRAZ	meru	-10.0		+10.0			at
Δ ADSRAX	meru	-10.0		+10.0			au
Δ ADIAX	meru	-15.0		+15.0			av
Δ ADIAZ	meru	-15.0		+15.0			aw
Δ ADIAY	meru	-15.0		+15.0			ax
X PIPA S. F. from line z	cm/sec /pulse	.9996		1.0004			ay
Y PIPA S. F. from line aa	cm/sec /pulse	.9996		1.0004			az
Z PIPA S. F. from line ab	cm/sec /pulse	.9996		1.0004			ba
X PIPA Bias from line ac	cm/sec^2	-0.5		+0.5			bb
Y PIPA Bias from line ad	cm/sec^2	-0.5		+0.5			bc
Z PIPA Bias from line ae	cm/sec^2	-0.5		+0.5			bd

TABLE I

JDC	PARAMETER	VALUE
16236	BDX	
16236	ADSRAX	
16237	ADIAX	
16239	BDY	
16239	ADSRAY	
16240	ADIAY	
16242	BDZ	
16242	ADSRAZ	
16243	ADIAZ	

TABLE 1a

Y	Y'
0	2
1	3
2	2
3	3
4	6
5	7
6	6
7	7

6.3.10 LGC Voltage Margin Test

6.3.10.1 Initial Conditions

6.3.10.1.1 Insure that the G&N System is in Operate Mode.

6.3.10.1.2 On the CRT, verify the +28 VDC LGC OPERATE bus is between 24.5 and 33.5 vdc (GG 1520).

6.3.10.2 Voltage Margin Determination

6.3.10.2.1 On the PSA Adapter Module (PSAAM) (410-31080), place INHIBIT VOLTAGE FAIL switch to ON.

> CAUTION: The +4 vdc LGC Supply voltage shall never by operated lower than +2.5 vdc or higher than +5.2 vdc (GG 1030).
>
> The +14 vdc LGC Supply shall never be operated less than +8.5 vdc or higher than +17.0 vdc (GG 1020).
>
> NOTE: The flashing indication of the LGC supplies may be disregarded for this test. The charts in Table II may be used to determine approximate values for "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.

6.3.10.2.2 Enter 0001 into R155. Verify and execute.

6.3.10.2.3 Enter 1111 into R154. Verify and execute.

6.3.10.2.4 Enter in C-156 ±XX.X001114. (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 12.1 (+0.3, -0) vdc. See Table II). Execute.

6.3.10.2.5 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the +4V power supply (GG 1030) as monitored on the CRT, to 3.5 (+0.15, -0) vdc. See Table II). Execute.

6.3.10.2.6 On K-148 press ERROR RESET.

6.3.10.2.7 On K-148 initiate LGC Self-Check by entering the following:

```
VERB 21 NOUN 27 ENTR
77767           ENTR
```

Wait 200 seconds. Verify RESTART lamp on the DSKY is not lit

6.3.10.2.8 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.9 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations

```
VERB 21 NOUN 27 ENTR
77767           ENTR
```

6.3.10.2.10 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 16.4 (+0, -0.4) vdc. See Table II Execute.

6.3.10.2.11 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.12 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations

VERB 21 NOUN 27 ENTR
77767 ENTR

6.3.10.2.13 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the 4V power supply (GG 1030) as monitored on the CRT, to 4.5 (+0, -0.2) vdc. See Table II). Execute.

6.3.10.2.14 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.

6.3.10.2.15 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lit. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:

VERB 21 NOUN 27 ENTR
77767 ENTR

6.3.10.2.16 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the 14V power supply (GG 1020) as monitored on the CRT, to 12.2 (+0.3, -0) vdc. See Table II). Execute.

6.3.10.2.17 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.18 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.19 On R-154 enter 0000. Execute

6.3.10.2.20 On R-155 enter 0000. Execute

6.3.10.2.21 On K-148 terminate the LGC Self-Check by entering the following:

VERB 21 NOUN 27 ENTR
00000 ENTR

6.3.10.2.22 On K-148 press ERROR RESET.

6.3.12.1.5 After 10 seconds has elapsed since step 6.3.12.1.1, enter the following into K-148:

VERB 21 NOUN 01 ENTR
00403 ENTR
00000 ENTR

6.3.12.1.6 Verify on CRT, DSKY display

VERB 21 NOUN 01
R1 = 00000
R3 = 00403

6.3.12.1.7 On K-148 enter the following sequence:

NOUN 15 ENTR
00000 ENTR ENTR (Push ENTR pushbutton twice)
Verify R1 = +00000
37777 ENTR ENTR
Verify R1 = 37777
37743 ENTR ENTR
Verify R1 = 37743
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR (once)
Verify R1 = 00000

6.3.12.1.8 Start analog recorders using a chart speed of 10 mm/sec (IG - 360° TORQUE)

6.3.12.1.9 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTR
00370 ENTR
Record contents of CRT DSKY Row 1 xxxxY
VERB 21 NOUN 01 ENTR
00370 ENTR
XXXXY' ENTR
Where Y' is obtained from Table 1a
VERB 42 ENTR
VERB 33 ENTR

6.3.12.1.10 Monitor analog recorder. When the IG Torque Motor Current signal (GG2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.1.11 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.12.1.12 On the CRT, verify CDU X, CDU Y, CDU Z all indicate +00000 (±00200).

6.3.14 G&N Fine Alignment Test

6.3.14.1 On K-148 enter:

VERB 01	NOUN 10	ENTR
00003		ENTR

6.3.14.2 Record CRT, DSKY Row 1 display as AAAAA and the time of day.

6.3.14.3 On K-148 enter:

VERB 21	NOUN 01	ENTR
01300		ENTR
AAAAA		ENTR
VERB 06	NOUN 02	ENTR
01300	ENTR	

6.3.14.4 Record CRT DSKY Row 1 display as ±BBBBB

6.3.14.5 Perform the following calculations:

a. $\frac{\text{BBBBBX } 5.12}{3600}$ = CCCC.C — Contents of high order scalar register in hours.

b. 23.3 - CCCC.C = DDDD.D — Time left in high order scalar register until overflow.

c. DDDD.D + time of day recorded in step 3 = time of day at which high order scalar register will overflow.

6.3.14.6 If the time of day is within 12 minutes of that time calculated in 6.3.14.5.c when about to complete step 6.3.14.30 wait until that time calculated in c has passed and then proceed.

NOTE: Use of Dioptometer is required for all optical sightings using AOT.

6.3.14.7 On K-148 enter:

VERB 01	NOUN 01	ENTR
00370		ENTR
Record contents of DSKY Row 1 xxxxY		
VERB 21	NOUN 01	ENTR
000370		ENTR
XXXXY'		ENTR
Where Y' is obtained from Table 1a.		
VERB 57		ENTR
00003		ENTR

6.3.14.8 Verify CRT DSKY display as:

VERB 06	NOUN 61	(Flashing)
R1 = +13500		(SM Azimuth)
R1 = +40.748		(Site Latitude)

NOTE: If R1 and R2 indications are correct proceed to step 6.3.14.10.

6.3.14.38 Results. The PIPA bias determined previously in the IMU Performance Test (6.3.9) must be subtracted from the resultant data of the test.

6.3.14.38.1 Y PIPA misalignment

	R1	R2
About Z axis (from 6.3.14.31) =	±XXXXX.	XXXXX sec
Less Y PIPA bias (from 6.3.9) =	-(±XXXXX.	XXXXX) sec
Y PIPA misalignment about Z axis =	-------	------- sec

This value shall not exceed ±255 sec

6.3.14.38.2 Z PIPA misalignment

	R1	R2
About Y axis (from 6.3.14.32) =	±XXXXX.	XXXXX sec
Less Z PIPA bias (from 6.3.9) =	- (±XXXXX.	XXXXX) sec
Z PIPA misalignment about Y axis =	± -------	------- sec

This value shall not exceed ±255 sec

6.3.14.38.3 Z PIPA misalignment

	R1	R2
About Y axis (from 6.3.14.35) =	±XXXXX.	XXXXX sec
Less X PIPA bias from (6.3.9) =	-(±XXXXX.	XXXXX) sec
X PIPA misalignment about Y axis =	± -------	------- sec

This value shall not exceed ±255 sec

6.3.14.38.4 Y PIPA misalignment

	R1	R2
About X axis from (6.3.14.36) =	±XXXXX.	XXXXX sec
Less Y PIPA bias (from 6.3.9) =	-(±XXXXX.	XXXXX) sec
Y PIPA misalignment about X axis =	± -------	------- sec

This value shall not exceed ±255 sec

6.3.15 AOT Functional Accuracy Test

NOTE: Use of a Dioptometer is required when sighting through AOT.

6.3.15.1 Determination of Detent Angle Reference.

NOTE: The included angles between targets LOS shall be known to ±10 arc seconds. The elevation of each target LOS shall be known to ±15 arc seconds.

6.3.15.1.1 Place AOT in L detent position.

NOTE: Communication between AOT and target theodolite operators is required.

APPENDIX I

MEASUREMENT TOLERANCES

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY 1% OF FULL SCALE
GG 1020 link 4*	+14 vdc LGC Supply	14.0±0.2 vdc	0%
GG 1030 link 4	+4 vdc LGC Supply	4.0±0.15 vdc	0%
GG 1040 link 5**	+120 vdc PIPA Supply	120±6.0 vdc	1%
GG 1070 link 4	+4 vdc CDU Supply	4.0±0.2 vdc	0%
GG 1100 link 4	-28 vdc Supply	-27.5±6.0 vdc	0%
GG 1110 link 5	2.5 vdc Telemetry Bias No. 1	2.5±0.1 vdc	0%
GG 1201 link 5	IMU 28V 800 cps 1%	28±0.56V rms	1%
GG 1202 link 4	IMU 28V 800 cps 5%	28±1.4V rms	1.5%
GG 1203 link 4	IMU 28V 800 cps 5%	28±2.1V rms	1.5%
GG 1331 link 5	3.2 kc 28V Supply 1%	28.6±0.56V rms	1%
GG 1500 link 4	+28 vdc IMU Oper BUS	28.0 -3.5, +5.5 vdc	0%
GG 1510 link 4	+28 vdc IMU STBY BUS	28.0 -3.5, +5.5 vdc	0%
GG 1513X link 5	+28 vdc IMU STBY/OFF	28.0±1 vdc	0%
GG 1520 link 4	+28 vdc LGC Oper BUS	28.0 +4.5, -3.5 vdc	0%
GG 1523X link 5	+28 vdc LGC Operate	28.0±1 vdc	0%
GG 2001 link 5	X PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2021 link 5	Y PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2041 link 5	Z PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2106 link 4	IG Servo Error Total	0.0±60 MV rms at null	1%
GG 2107 link 5	IG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2110 link 4	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2110 link 5	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2112 link 5	IG 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 2113 link 5	IG 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 2121 link 5	IG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2136 link 4	MG Servo Error Total	0.0±60 MV rms at null	1%
GG 2137 link 5	MG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2140 link 5	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2140 link 5	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2142 link 5	MG 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 2143 link 5	MG 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 2151 link 5	MG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2166 link 4	OG Servo Error Total	0.0±60 MV rms at null	1%
GG 2167 link 5	OG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2170 link 4	OG Torque Motor Current	0.9 AMP Max during any fine Align Torque	0%

APPENDIX I (Continued)

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY % OF FULL SCALE
GG 2170 link 5	OG Torque Motor Current	0.9 AMP Max during any fine Align Torque	1%
GG 2172 link 5	OG 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 2173 link 5	OG 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 2181 link 5	OG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2219 link 5	Pitch Attitude Error	5.05±0.5V rms at 17°	1%
GG 2220 link 4	IG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2221 link 4	IG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2249 link 5	YAW Attitude Error	5.05±0.5V rms at 17°	1%
GG 2250 link 4	MG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2251 link 4	MG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2279 link 5	Roll Attitude Error	5.05±0.5V rms at null	1%
GG 2280 link 4	OG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2281 link 4	OG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2300 link 5	PIPA Temperature	130.5±1.5°F in Operate	1%
GG 2301 link 4	IRIG Temperature	135±2.5°F in Operate	1%
GG 2301 link 5	IRIG Temperature	135±2.5°F in Operate	1%
GG 2302 link 4	IMU Heater Current On	28±1 vdc	0%
GG 2303 link 4	IMU Blower Current On	28±1 vdc	0%
GG 3304 link 5	RR Shaft 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3305 link 5	RR Shaft 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 3311 link 4	RR Shaft CDU Fine Error	0.0±0.07V rms at null	1%
GG 3312 link 4	RR Shaft CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3321 link 4	RR Trunnion CDU Fine Error	0.0±0.07V rms at null	1%
GG 3322 link 4	RR Trunnion CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3324 link 5	RR Trunnion 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3325 link 5	RR Trunnion 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 4300 link 4	LGC Temperature	87.5±42.5°F	0%
GG 6020 link 4	PIPA Calibration Module Temperature	67.5±22.5°F	0%
GG 6020 link 5	PIPA Calibration Module Temperature	67.5±22.5°F	0%
GG 6021 link 4	PSA Temperature	85±25.0°F	0%

* Link 4 - PSAAM Output Signal

** Link 5 - SCA Output Signal

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6.3.16.14 Algebraically add φ (vert) from the Row 1 DSKY display recorded in 6.3.16.11. The resultant azimuth error shall be 000.00±000.57 degrees.

6.3.16.15 Algebraically subtract the value recorded in 6.3.16.12.6 from the Row 3 DSKY display recorded in 6.3.16.11. The resultant vertical error about Z local vertical shall be 000.00±000.06 degrees.

6.3.16.16 Algebraically subtract the value recorded in 6.3.16.12.7 from the Row 2 DSKY display recorded in 6.3.16.11. The resultant vertical error about Y local vertical shall be 000.00±000.06 degrees.

6.3.16.17 Two hours after 6.3.16.10 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.16.18 The CRT DSKY display of Row 1 shall be within 000.06 degrees of the value recorded in 6.3.16.11. The CRT DSKY display of Row 2 and Row 3 shall be within 000.03 degrees of the respective values recorded in 6.3.16.11.

6.3.16.19 On K-148 enter the following:

VERB 36		ENTR
VERB 40	NOUN 20	ENTR
+00000		ENTR
+00000		ENTR
+00000		ENTR

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ND 1002323 REV C

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POST-INSTALLATION CHECKOUT SPECIFICATION
FOR LEM GUIDANCE AND NAVIGATION SYSTEM

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	APPROVALS AC	APPROVALS NASA
11/22/66	A	32056	1-83 Was 83 pages, now 80 pages.	EA	WLS
12/29/66	B	32480	6-46, 51, 62, 67, 73, 74, 78	JP	- -
2/27/67	C	33084	5-86	EA	—

This specification consists of page 1 to 86 inclusive.

APPROVALS	NASA/MSC				9/23/66

5. GENERAL REQUIREMENTS

5.1 SAFETY REQUIREMENTS

5.1.1 Operator Safety

5.1.1.1 Normal safety precautions shall be observed through the G&N post-installation checkout.

5.1.2 Equipment Safety

5.1.2.1 To preserve the operational life of the components of the G&N hardware under test, settings and adjustments shall be performed only when specified in the test procedure. Care shall be exercised in the accomplishment of all settings and adjustments to avoid excessive wear or damage to the equipment. All precautionary measures stated throughout the test procedures shall be strictly adhered to.

5.1.2.2 . Prior to the electrical connection of the G&N System to the spacecraft harness, a complete verification of spacecraft power, including both voltage polarity as well as magnitude, shall be completed to preclude damage to the G&N due to incorrect power application.

5.1.2.3 The connection between the Portable Temperature Controller (PTC) and 56J1 shall be maintained unless otherwise specified.

5.1.2.4 The temperature of the inertial components shall be maintained between the following limits. If these limits are exceeded, the inertial components shall be recalibrated.

a. IRIG: 120 Deg F and 150 Deg F
b. PIP: 115 Deg F and 145 Deg F

5.1.2.5 All personnel concerned shall thoroughly understand the Operational Requirements in Section 6.2 to preclude any damage to the G&N System.

5.1.2.6 To preserve the operational life of the components of the DSKY, the monitor routines shall be used only when required by test procedure or trouble shooting. Such routines shall be terminated as quickly as possible in the test flow. Computer routines which cause the DSKY display to flash (either requesting data or displaying data) shall also be terminated as quickly as possible.

5.2 COOLANT REQUIREMENTS

5.2.1 When electrical power is applied to the G&N System, the IMU shall be provided with water-glycol coolant at a temperature of 32 to 50 Deg F and a flow rate of 33±5 pounds per hour.

5.2.2 The PSA, CDU, and PTA cold plates shall be provided with coolant as per ICD LIS-510-10001.

5.3 TEST EQUIPMENT TOLERANCES

5.3.1 Measurement and tolerance specifications stated herein are basic G&N system performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. Final tolerances must include PSAAM and SCA stability uncertainties. All uncertainties due to instrumentation shall be root sum squared with the basic G&N tolerances to yield an acceptable tolerance for use when testing the G&N system in the spacecraft.

5.3.2 In the event of a conflict between requirements, the following order of precedence shall apply. The contractor shall also notify AC Electronics Site Manager of the conflict.

a. The contract
b. This specification
c. Documents referenced in this specification

5.4 TEST SEQUENCE

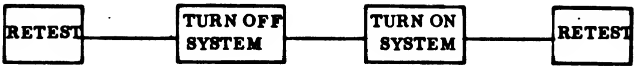
5.4.1 The test sequence shall normally follow the flow gram in Figure 1. Any test subsequent to Temperature Control Verification Section 6.3.4 may be conducted providing the General Turn On Procedure 6.2.4 is followed.

5.5 The generation of a noise alarm indication, as evidenced by one or more Noise Peak Event lamps becoming lighted shall be cause for immediate determination of effects on the G&N system test in progress. In the event of detrimental effects on the system test a troubleshooting routine shall be entered to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.

5.6 TEST FAILURE CRITERIA

5.6.1 IRIG and PIPA data (See paragraph 6.3.9)

5.6.1.1 If D_1, D_2, or D_3 exceeds its maximum value for any PIPA or IRIG, that PIPA or IRIG shall be retested in the following sequence.



If D_1, D_2, and D_3 are within tolerance after the retest sequence is completed, the original out-of-tolerance terms calculated in paragraph 6.3.9.70.4 shall be exonerated.

5.6.1.2 Failure to be within the maximum values of D_1, D_2, and D_3 after the retest sequence of 5.6.1.1 shall constitute a failure of the assembly.

5.6.2 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N System as non-conforming. Normal test sequence may be continued upon determination of the cause of the nonconformance or at the discretion of the G&N contractor test team if it is determined that such action is not detrimental to the G&N System or other interfacing subsystems. All nonconformances shall be investigated and cleared by waivers (F.N.N.), correction of specification, or hardware replacement and retest. The suspected malfunctioned hardware shall be removed and returned to the laboratory where the malfunction shall be verified. Only after malfunction verification shall a flight certified replaceable element be installed in the G&N System.

5..7 After the defective replaceable element has been substituted with a flight certified unit, the G&N System checkout sequence shall regress to the rerunning of applicable portions of the selected sequence (by paragraph numbers) categorised by the subassemblies in which the malfunction occurred. The chosen subassembly categories are presented in Table A versus an appropriate retest paragraph sequence as a guide for applicable portions of indicated paragraph numbers in the sequence listed as indicated under the appropriate subassembly heading or as directed by NASA Test Engineering. Retest shall proceed to the point in the normal test sequence at which the discrepancy was detected and corrected. Normal testing shall continue beyond this point in the specified sequence of Figure 1.

5.8 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps pertaining directly to the G&N components. If any questions arise concerning the test equipment, the Test Conductor should refer to the respective operational manuals.

5.9 Spacecraft systems other than the G&N System may be operating on a noninterfering basis while individual system checkout of the G&N is being conducted.

5.10 DATA RETRIEVAL

5.10.1 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance reading shall be recorded and flagged by appropriate signals.

TABLE A

RETEST SEQUENCE

Paragraph Number	Test Title	LGC	IMU	PSA	CDU	PTA	DSKY	A Harness	B Harness	Computer Control and Reticle Dimmer	Nav Base	Alignment Optical Telescope	Signal Conditioner
6.3.1	Standby Power On Test	X	X	X			X	X	X		X		
6.3.2	Alarms and Interrupts Test	X					X	X					
6.3.3	IMU Operate Power On Test		X	X	X	X		X	X		X		X
6.3.4	Temperature Control Verification		X	X				X	X		X		X
6.3.5	PGNCS Power Supply Test			X	X	X		X	X		X		X
6.3.6	IMU Operational Test	X	X	X	X	X		X	X		X		
6.3.7	PGNCS Operational Test		X	X	X			X	X		X		X
6.3.8	IRIG Scale Factor Test		X	X		X		X	X		X		
6.3.9	IMU Performance Test		X	X		X		X	X		X		
6.3.10	LGC Voltage Margin Test	X						X					
6.3.11	LGC Clock Frequency Test	X						X		X			
6.3.12	Gimbal Friction Test		X	X				X	X		X		X
6.3.13	Stabilization Loop Response Test		X	X		X		X	X		X		
6.3.14	G&N Fine Alignment Test		X	X	X			X	X	X	X	X	
6.3.15	AOT Functional Performance Test											X	
6.2.1	Emergency Shutdown Procedure	*	*	*	*	*	*	*	*	*	*	*	*
6.2.2	Normal Shutdown Procedure	*	*	*	*	*	*	*	*	*	*	*	*
6.2.3	Initial Turn-On Procedure	*	*	*	*	*	*	*	*	*	*	*	*
6.2.4	General Turn-On Procedure	*	*	*	*	*	*	*	*	*	*	*	*

*To be used as necessary to turn system on or off

Paragraph No.	Test Title
6.3.1	Standby Power In Test
6.3.2	Alarms and Interrupts Test
6.3.3	IMU Operate Power On Test
6.3.4	Temperature Control Verification
6.3.5	PGNCS Power Supply Test
6.3.6	IMU Operational Test
6.3.7	PGNCS Operational Test
6.3.8	IRIG Scale Factor Test
6.3.9	IMU Performance Test
6.3.10	LGC Voltage Margin Test
6.3.11	LGC Clock Frequency Test
6.3.12	Gimbal Friction Test
6.3.13	Stabilization Loop Response Test
6.3.14	G&N Fine Alignment Test
6.3.15	AOT Functional Performance Test

TEST SEQUENCE

FIGURE 1

5.10.2 During G&N system testing, all interleaved data, Uplink Command Files and Downlink Data File shall be maintained (recorders On). All A/B PCM data that is not made available to the ACE displays shall be verified by requesting a time history data strip out of said data for the time period when the test was performed.

6. DETAILED REQUIREMENTS

6.1 INITIAL TEST CONDITIONS

6.1.1 The IMU shall be supplied with heater power on a continuous basis. The Portable Temperature Controller (Model No. 410-31058) shall be connected at all times although heater power may be supplied from the +28 VDC IMU STANDBY bus and monitored through ACE.

6.1.2 The IMU shall never be without heater power longer than 15 minutes.

6.2 OPERATIONAL REQUIREMENTS

NOTE: In the event that an Electrical Power Subsystem (EPS) Shutdown occurs for any reason while the G&N System is in the Operate Mode, turn off the +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Do not turn the +28 VDC IMU OPERATE circuit breaker on for a minimum of 5 minutes after the EPS shutdown occurs. Failure to observe this requirement can result in shifts of the critical Inertial Component parameters.

6.2.1 Emergency Shutdown Procedure

CAUTION

In the event of any malfunction which might damage the G&N System before the normal shutdown procedure in 6.2.2 can be performed, power shall be removed from the G&N System as soon as possible. If at all possible, without creating any delay, IMU Operate power should be removed first.

6.2.2 Normal Shutdown Procedure

6.2.2.1 The normal shutdown of a G&N System shall include parking the gimbals prior to removing IMU Operate Power. This is accomplished in the following procedure.

6.2.2.2 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+09000 ENTR

6.2.4.6 On K-148 enter the following sequence:

ERROR RESET
VERB 36 ENTR (fresh start)
VERB 57 ENTR
00015 ENTR (clear erasable memory)
VERB 21 NOUN 27 ENTR
77777 ENTR (LGC Self Check)

6.2.4.7 On the CRT, verify that the 3.2KC 28V Supply indicates between 28.04 and 29.16 VRMS (CG 1331).

6.2.4.8 On the CRT, verify that R1 does not display 01102 or 41102 (indicating a malfunction).

6.2.4.9 Wait 5 minutes then enter the following in K-148.

a.	VERB 25 NOUN 01	ENTR
b.	03770	ENTR SET LOC.
c.	10067	ENTR CSS NEW JOB
d.	04317	ENTR TC CHANG 1
e.	01770	ENTR TC ACTLITON
f.	VERB 25 NOUN 26	ENTR CALL PRIO/DELAY
g.	01000	ENTR 01 PRIORITY
h.	01770	ENTR RELATIVE E-MEM
i.	00007	ENTR BANK ADD.
j.	VERB 30	ENTR REQ EXEC.

NOTE: If a VERB 36 is performed after the above information has been entered, repeat lines 6.2.4.9.f through 6.2.4.9.j.

6.2.4.10 CAUTION: LGC OPERATE AND IMU STANDBY power must have been applied a minimum of two hours before energizing the IMU OPERATE circuit breaker in step 6.2.4.16 unless all of the following conditions are met:

IF:
1. The G&N System has previously been in Standby Mode at least two hours and subsequently been in Operate Mode, AND
2. The gimbals were placed in a parked position prior to shutdown, AND
3. The shutdown period did not exceed 5 days, AND
4. The Spacecraft or IMU have not been moved in any way during the shutdown period.

THEN: The two-hour standby Mode operation requirement is reduced to 15 minutes.

6.2.4.11 The G&N System is defined as being in Standby Mode when LGC Operate and IMU Standby power is applied and IMU Operate power is off. The inertial components shall have suspension power in Standby Mode.

6.2.4.12 The G&N System is defined as being in Operate Mode when LGC OPERATE, IMU STANDBY and IMU Operate Power is applied to the system.

6.2.4.13 Set up analog recorder to monitor the following signals:

	Signal No.	Signal Name
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 CPS

6.2.4.14 Start the analog recorder at a chart speed of 5 mm/sec. Start event recorder at a chart speed of 1 mm/sec.

6.2.4.15 On CRT, monitor +120 VDC PIPA SUPPLY (GG1040) and IMU gimbal angles. Record time. If 15 minutes have elapsed since performing Paragraph 6.2.4.3, proceed to the next paragraph.

6.2.4.16 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.2.4.17 Verify on analog recorder that the oscillations of the resolver sine signals (GG2112, GG2172 and GG2142) are not sustained and that the signals damp out within 15 seconds. If this condition is not attained, remove IMU OPERATE power immediately.

6.2.4.18 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.2.4.16 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.2.4.16.

6.2.4.19 Verify absence of LGC WARNING, ISS WARNING, and PGNCS CAUTION lights in the LEM cabin.

6.2.4.20 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.2.4.21 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.2.4.22 On the CRT, scan the power supply voltages to verify their normal operation. (No indications flashing).

6.2.4.23 After all the tests of 6.3 in Figure 1 have been completed, the General Turn-On Procedure (6.2.4) and IMU Operational Test (6.3.6) shall be completed before re-running any test. Otherwise, the testing sequence shall continue in accordance with Figure 2.

6.2.5 Interruption of Power

6.2.5.1 IMU Operate power shall never be applied without the presence of LGC Operate and IMU Standby Power.

6.2.5.2 The G&N System log book shall include the gimbal positions at time of power shutdown. If omitted, it shall be assumed that the gimbals were not parked prior to shutdown. The log book shall also state if any movement of the IMU or Spacecraft has taken place after shutdown. The times of application and removal of any bus power to the G&N System shall be recorded.

6.2.5.3 After the system has been operating with IMU Operate power on, and a power interruption occurs, a minimum of 15 minutes operation in Standby Mode is required before resuming IMU Operate power. If the power interruption was longer than 15 minutes, the G&N System shall be run in Standby Mode for a time interval at least equal to the duration power was off before resuming IMU Operate power. However, this period need not exceed two hours before application of IMU Operate power.

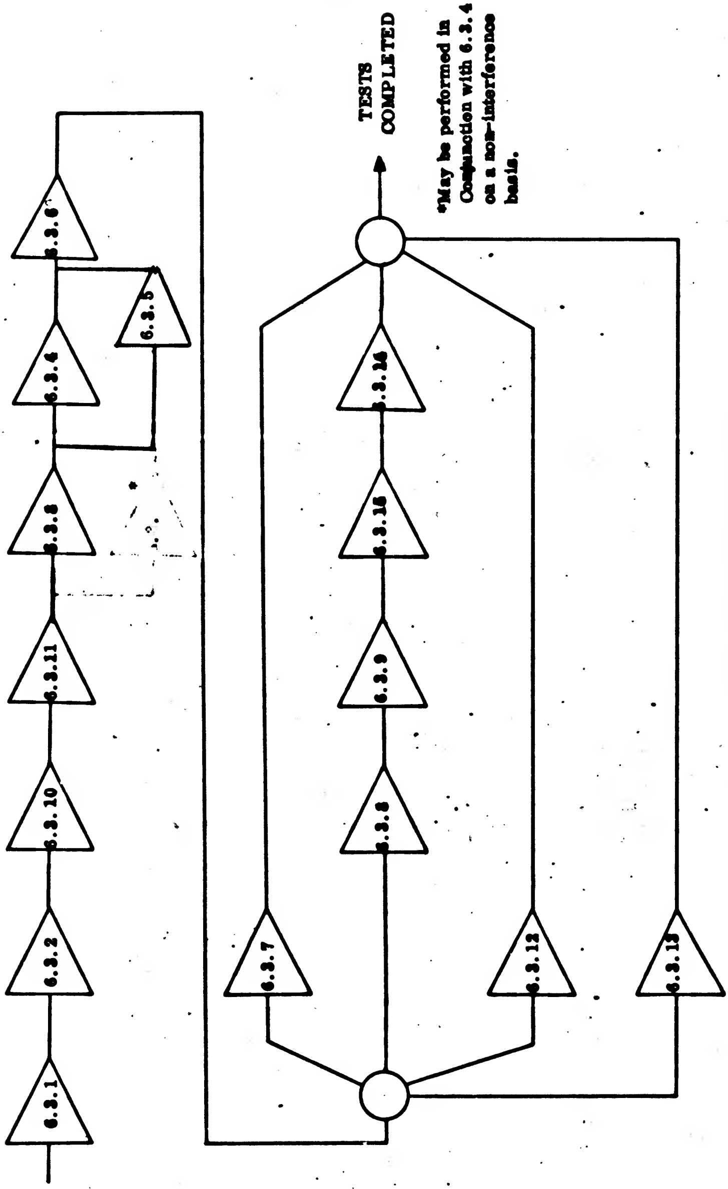
6.2.6 A warmup period of at least one hour in Operate mode is required prior to performing any test in which gyro or accelerometer parameters are measured, and at least 15 minutes prior to any test in which precision amplitude and frequency power supply checks are made.

6.3 TEST PROCEDURES

6.3.1 Standby Power On Tests

6.3.1.1 The Portable Temperature Controller, Model No. 400-31058 shall be supplying inertial component heater power to the G&N System through connector 56J1 (P230). If alarm or fail indications are present on the PTC, they shall be cleared by depressing the SYSTEM RESET pushbutton on the PTC.

6.3.1.2 Verify that spacecraft power checks, including both polarity as well as magnitude on the spacecraft power connectors, have been accomplished.



*May be performed in Conjunction with 6.3.4 on a non-interference basis.

TEST PROCEDURE FLOWGRAM

FIGURE 2

6.3.1.3 The following switches and/or circuit breakers shall be closed to energize the indicated buses.

LOCATION	NOMENCLATURE	IDENTIFICATION
Panel 14	BAT 5 NORMAL FEED	4S10
Panel 14	BAT 6 NORMAL FEED	4S11
Panel 16	X LUNAR BUS TIE	4CB5
Panel 16	BAT 1-4-6 FEED TIE	4CB17
Panel 16	BAT 2-3-5 FEED TIE	4CB25
Panel 16	ASC ECA	4CB14
Panel 16	ASC ECA CONT.	5CB7
Panel 16	DC BUS VOLT	4CB21
Panel 16	DISP.	4CB16
Panel 11	X LUNAR BUS TIE	4CB4
Panel 11	BAT 1-4-6 FEED TIE	4CB18
Panel 11	BAT 2-3-5 FEED TIE	4CB26
Panel 11	ASC ECA	4CB15
Panel 11	ASC ECA CONT.	4CB6
Panel 11	DC BUS VOLT	4CB22
Panel 16	INV. NO. 2	4CB13
Panel 14	AC PWR to INV 2 Position	4S14
Panel 11	AC BUS FEED TIE	4CB24
Panel 11	AC BUS VOLT	4CB27

6.3.1.4 IMU Standby Power Turn On

6.3.1.4.1 Turn on Event Recorder at a speed of .1 mm/sec. (10/100 mm/sec.).

6.3.1.4.2 Press in +28VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11. Record time.

6.3.1.4.3 Verify on event recorder that +28 VDC IMU STANDBY power discrete (GG 1513) is on. On CRT, +28V IMU STANDBY Bus (GG 1510) shall indicate between 24.5 and 30.5 [illegible]

6.3.1.4.4 On CRT, the 28V 3200 CPS SUPPLY (GG 1331) shall indicate between 28.04 and 29.16 VRMS. Record this value.

6.3.1.4.5 The PIPA TEMP displayed on CRT, shall be monitored periodically for one hour to ensure that the PIPA Temperature Control circuitry is operating to maintain a temperature of 130±5.0 DEG F. (GG [illegible]). Two hours after performing step 6.3.1.4.2 record PIPA TEMP.

6.3.1.5 Computer Power Turn On

6.3.1.5.1 Press in +28VDC LGC OPERATE circuit breaker (in LEM Cabin Panel 11.
Panel 11.

6.3.1.5.2 Depress STBY pushbutton on DSKY for three seconds and verify STBY light on DSKY is OFF.

6.3.1.5.3 On CRT, +28V LGC Operate Bus (GG1520) shall indicate between (24.5 and 33.5). Ignore computer alarm indications. Using DSKY, enter VERB 36, then press RSET. All computer alarms shall clear.

6.3.1.5.4 On CRT, the +14VDC LGC SUPPLY (GG 1020) shall indicate between 13.6 and 14.4 VDC. Record this value.

6.3.1.5.5 On CRT, the +4 VDC LGC SUPPLY (GG 1030) shall indicate between 3.6 and 4.2 VDC. Record this value.

6.3.1.6 LGC Operational Tests

6.3.1.6.1 DSKY Check

6.3.1.6.1.1 Initiate the DSKY check by entering in the DSKY:

Press ERROR RESET
~~VERB 37 ENTR 00015 ENTR (clear erasable memory)~~
VERB 21 NOUN 27 ENTR
00011 ENTR

6.3.1.6.1.2 All the electroluminescent elements (PROG, VERB, NOUN, and Row 1, Row 2, Row 3) shall display the decimal number (8). ~~(Including the 8's, each of the following~~ shall be displayed for approximately 5 seconds.

a. 9's
b. 8's
c. 7's
d. 6's
e. 5's
f. 4's
g. 3's
h. 2's
i. 1's
j. 0's
k. Minus signs in Row 1, ROW 2, ROW 3 } On concurrently for 5 seconds
l. VERB-NOUN Flashing }
m. COMP ACTY }

o. Plus signs in ROWS 1, 2, and 3
p. VERB-NOUN Flashing
q. COMP ACTY

On concurrently for 5 seconds

r. COMP ACTY - On for 5 seconds then DSKY blanks.

6.3.1.6.1.3 The DSKY pushbuttons shall be checked by entering:

```
VERB 25 NOUN 01 ENTR
01740 ENTR
+00123 ENTR
-00456 ENTR
-00789 DO NOT press ENTR
```

The DSKY shall display +00123 in Row 1, -00456 in Row 2, and -00789 in Row 3. Press CLR pushbutton three times on DSKY. Observe that Row 1, Row 2, and Row 3 are blank.

6.3.1.6.2 Lamp Test

6.3.1.6.2.1 Initiate the Lamp Test by entering in the DSKY:

```
VERB 35 ENTR
```

6.3.1.6.2.2 The following DSKY displays shall illuminate for 5 seconds

a. UP LINK ACTY
b. NO ATT
c. STBY
d. KEY REL
e. TEMP
f. GIMBAL LOCK
g. PROG
h. RESTART
i. TRACKER
j. OPR ERROR Flashing
k. VERB-NOUN Flashing
l. Plus 88888 in Row 1, Row 2, and Row 3

On concurrently for 5 seconds

6.3.1.6.3 Uplink Check

6.3.1.6.3.1 On K-START 148; set UPLINK/INHIBIT switch to LOAD, set TAPE/KEY switch to KEY, then enter the following:

```
ERROR RESET
VERB 25 NOUN 01 ENTR
02400 ENTR
+01234 ENTR
-56789 ENTR
+00000 ENTR
```

6.3.1.6.3.2 Verify the following is displayed on the DSKY.

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.4 Downlink Check

6.3.1.6.4.1 On CRT, DSKY display, verify the following is displayed:

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.5 LGC Self-Check

6.3.1.6.5.1 On K-148, enter the following sequence to initiate the LGC Self-Check:

VERB 25 NOUN 27 ENTR ENTR
VERB 21 ENTR NOUN 27 ENTR
VERB 15 NOUN 01 ENTR ENTR
VERB ENTR NOUN 01 ENTR
01366 ENTR

6.3.1.6.5.2 On the CRT, DSKY display, verify that R1 does not display 01102 or 41102. If a malfunction occurs, the following is displayed:

R1 01102 or 41102
R2 XXXXX a (S FAIL) program address +1 of point of failure
R3 XXXXX number of fails

6.3.1.6.5.3 When R3 = 00002, stop the LGC Self Check by entering in K-148 the following:

VERB 34 ENTR
VERB 21 NOUN 27 ENTR
00000 ENTR

6.3.1.6.6 LGC Standby Check

6.3.1.6.6.1 On K-148 enter the following sequence:

VERB 21 NOUN 10 ENTR
00013 ENTR
02000 ENTR

6.3.1.6.6.2 On DSKY depress STBY pushbutton for approximately 3 seconds.

6.3.1.6.6.3 Verify STBY status indicator lamp is ON.

6.3.1.6.6.4 On the CRT, verify the 3.2KC 28V Supply (GG 1331) is between 28.04 and 29.16V RMS.

6.3.1.6.6.5 On DSKY depress STBY pushbutton for approximately 3 seconds to return to LGC OPERATE mode.

6.3.1.6.6.6 Verify STBY status indicator lamp is OFF.

6.3.2 Alarms and Interrupts Test

6.3.2.1 Parity Fail Test

6.3.2.1.1 On K-148 enter the following sequence

```
VERB 21 NOUN 02 ENTR
01600 ENTR
33777 ENTR
```

6.3.2.1.2 On CRT, DSKY display, verify R1 = 33777 and R3 = 01600

6.3.2.1.3 On K-148 enter the following sequence

```
VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR
```

6.3.2.1.4 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.1.5 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.2 Rupt Lock-Interrupt Too Long

6.3.2.2.1 On K-148 enter the following sequence

```
VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
00001 ENTR
01600 ENTR
00003 ENTR
VERB 31 ENTR
```

6.3.2.2.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.2.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.3 TC Trap Test

6.3.2.3.1 On K-148 enter the following sequence

```
VERB 21 NOUN 01 ENTR
01600 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR
```

6.3.2.3.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.3.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.4 Nightwatchman Test

6.3.2.4.1 On K-148 enter the following sequence

```
VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
03400 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR
```

6.3.2.4.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.4.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.3 IMU OPERATE POWER ON TESTS

CAUTION

Prior to application of IMU OPERATE power in step 6.3.3.1.4, LGC OPERATE and IMU STANDBY power must have been applied to the G&N System continuously for a minimum of two hours. The only exception is when the requirements of step 6.2.4.10 are met and this does not apply for the initial application of IMU OPERATE power.

6.3.3.1 Verification of Power Turn-On

6.3.3.1.1 Set up analog recorder to monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps
h.	SPARE	

6.3.3.1.2 Start analog recorder to a chart speed of 5 mm/sec. Start event recorder at a chart speed of .1 mm/sec. (10/100 mm/sec.).

6.3.3.1.3 On CRT, monitor +120 VDC PIPA SUPPLY (GG1040) and IMU gimbal angles.

6.3.3.1.4 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel Y1. Record time.

6.3.3.1.5 Verify on analog recorder that the oscillations of the resolver sine signals (GG2112, GG2172, and GG2142) are not sustained and that the signals damp out within 15 seconds. If they don't, remove IMU OPERATE power as soon as possible.

6.3.3.1.6 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.3.3.1.4 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.3.3.1.4.

6.3.3.1.7 On event recorder verify the following:

LGC WARNING is OFF (GG9001)
ISS WARNING is OFF (GG9002)
PGNCS CAUTION is OFF (GG9003)

6.3.3.1.8 On CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.3.1.9 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.4 Temperature Control Verification

6.3.4.1 When 15 minutes have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP (GG2300).

6.3.4.2 When 30 minutes have elapsed from the time of IMU OPERATE power turn-on record IRIG TEMP (GG2301).

6.3.4.3 When 1 hour has elapsed from the time of IMU OPERATE power turn-on, monitor PIPA TEMP (GG2300) and IRIG TEMP (GG2301) on the CRT. Monitor and record temperature readings every 5 minutes for one hour. Verify that each reading does not deviate from the average value of each signal by more than 0.1°F.

6.3.4.4 When 2 hours have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP and IRIG TEMP. The PIPA Temp shall be 130.5 (±1.5)°F. The IRIG TEMP shall be 135 (±2.5°)F.

6.3.4.5 The PIPA TEMP recorded in step 6.3.4.4 shall be within 0.5°F of temperature recorded in steps 6.3.1.4.5 and 6.3.4.1.

6.3.4.6 The IRIG TEMP recorded in step 6.3.4.4 shall be within 0.5°F of the temperature recorded in step 6.3.4.2.

6.3.5 PGNCS Power Supply Tests

6.3.5.1 From the CRT, confirm power supply voltages (or temperatures) are as specified and record values observed.

6.3.5.2 The PIPA Calibration Module Temperature (GG6020) shall be between +45 and +90 DEG F.

6.3.5.3 The PSA Temperature (GG6021) shall be between +60 and +110 DEG F.

6.3.5.4 The LGC Temperature (GG4300) shall be between +45 and +130 DEG. F.

6.3.5.5 The +28 VDC IMU OPERATE BUS (GG1500) shall be between 24.5 and 33.5 VDC.

6.3.5.6 The +28 VDC IMU STANDBY BUS (GG1510) shall be between 24.5 and 33.5 VDC.

6.3.5.7 The +28 VDC LGC OPERATE BUS (GG1520) shall be between 24.5 and 33.5 VDC.

6.3.5.8 The +120 VDC PIPA Supply (GG1040) shall be between 114 and 126 VDC.

6.3.5.9 The -28 VDC Supply (GG1100) shall be between -21.5 and -33.5 VDC.

6.3.5.10 The +4 VDC CDU Supply (GG1070) shall be between 3.8 and 4.2 VDC.

6.3.5.11 The IMU 28V 800 CPS 1 pct Supply (GG1201) shall be between 27.44 and 28.56 VRMS.

6.3.5.12 The IMU 28V 800 CPS 5 pct 90 PH Supply (GG1202) shall be between 26.6 and 29.4 VRMS.

6.3.5.13 The IMU 28V 800 CPS 5 pct 0 PH Supply (GG1203) shall be between 25.9 and 30.1V RMS.

6.3.5.14 The 3.2 KC 28V Supply (GG1331) shall be between 28.04 and 29.16V RMS.

6.3.5.15 The 2.5 VDC T/M Bias (GG1110) shall be between 2.4 and 2.6 VDC.

6.3.5.16 The +14 VDC LGC Supply (GG1020) shall be between 13.6 and 14.4 VDC.

6.3.5.17 The +4 VDC LGC Supply (GG1030) shall be between 3.8 and 4.2 VDC.

6.3.5.18 The phase difference between the 3.2 KC supply and LGC sync shall be 0° ±10° (NG1336).

6.3.6 IMU OPERATIONAL TEST

6.3.6.1 On K-148 enter the following:

VERB 01 NOUN 10 ENTR
00003 ENTR
Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.6.2 On K-148 enter the following:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 02 ENTR
01300 ENTR
Record CRT DSKY Row 1 indication as ±BBBBB

6.3.6.3 Perform the following calculations:

a. $\frac{\text{BBBBB} \times 5.12}{3600}$ = CCCC.C (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours

c. DDD.D + time of day recorded in 6.3.6.1 = time of day at which high order scalar register will overflow.

6.3.6.4 If time of day is within 12 minutes of that calculated in 6.3.6.3.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.6.3.c has passed and proceed.

6.3.6.5 In K-148 enter the following sequence:

VERB 57 ENTR
00004 ENTR
VERB 34 ENTR

6.3.6.6 Wait 200 seconds, then verify on the CRT, that the X, Y and Z PIPA SG Output signals all indicate 0.0±2.5 Volts but not 0.

6.3.6.7 Approximately 12 minutes after performing step 6.3.6.1, VERB 06 NOUN 66 shall flash.

6.3.6.8 From the CRT, DSKY display, read and record R1 and R2 (local gravity whole and fractional respectively). The value recorded shall be between 975.0 and 985.9 cm/sec^2.

6.3.6.9 On K-148 enter the following sequence.

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.6.10 From the CRT, DSKY display, read and record the horizontal fractional component of earth rate acting on the X, Y, and Z IRIG's as displayed in R2. The value recorded shall be between .65750 and .85750.

6.3.6.11 Terminate the test by entering in K-148 the following:

VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.7 PGNCS Operational Test

6.3.7.1 Start the PGNCS Operational test by inserting the following sequence into K-148:

VERB 57 ENTR
00010 ENTR
Program 07 shall be displayed
VERB 33 NOUN 01 is displayed flashing

6.3.7.2 Command Accuracy 0°

6.3.7.2.1 On K-148, press ENTR

VERB 33 NOUN 02 is displayed flashing
Press ENTR
VERB 33 NOUN 03 is displayed flashing

6.3.7.2.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 000±001 degrees.

6.3.7.2.3 Read and record CRT the DSKY Row 1, 2, and 3 indications. The indications shall be +00000±00007.

6.3.7.3 Command Accuracy 45°

6.3.7.3.1 On K-148, press ENTR, VERB 33 NOUN 04 is displayed flashing after approximately 20 seconds.

6.3.7.3.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 045±001 degrees.

6.3.7.3.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +04500±00007.

6.3.7.4 CDU Repeating Accuracy 45°

6.3.7.4.1 On K-148 press ENTR. In about 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.4.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.5 Command Accuracy 90°

6.3.7.5.1 On K-148 Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 06 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.5.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 090±001 degrees.

6.3.7.5.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be +09000±00007.

6.3.7.6 Command Accuracy 135°

6.3.7.6.1 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 07 is displayed flashing.

6.3.7.6.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 135±001 degrees.

6.3.7.6.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +13500±00007.

6.3.7.7 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 10 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.8 CDU Repeating Accuracy 135°

6.3.7.8.1 On K-148 press ENTR pushbutton. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.8.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.9 + Gimbal Lock Test

6.3.7.9.1 On K-148, Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 12 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.10 Command Accuracy 225°

6.3.7.10.1 On K-148 press ENTR. In approximately 20 seconds, VERB 33, NOUN 13 is displayed flashing.

6.3.7.10.2 Read and record the CRT indication of IMU gimbal angles. The indication shall be 225±001 degrees.

6.3.7.10.3 Read and record CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +225±00007.

6.3.7.11 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 14 is displayed. The GIMBAL LOCK lamp shall not be lighted.

6.3.7.12 CDU Command Rate Test

6.3.7.12.1 On K-148 press ENTR. In approximately 30 seconds VERB 06 NOUN 66 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.12.2 Read and record the CRT DSKY Row 1, 2, and 3 indications. The indication shall be between 00012 and 00016.

6.3.7.12.3 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.12.4 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on the DSKY shall not be lighted.

6.3.7.13 Command Accuracy 315°.

6.3.7.13.1 On K-148 insert VERB 33 ENTR. In approximately 20 seconds VERB 33 NOUN 20 will be displayed flashing.

6.3.7.13.2 Read and record CRT indication of IMU gimbal angles. The indications shall be 315±007 degrees.

6.3.7.13.3 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indications shall be +315 ± 00007.

6.3.7.14 CDU Repeating Accuracy 315°

6.3.7.14.1 On K-148 press ENTR. In approximately 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.14.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.15 -Gimbal Lock Test

6.3.7.15.1 On K-148 Press VERB 33 ENTR. In approximately 20 seconds VERB 33, NOUN 22 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.16 CDU Repeating Accuracy 225°

6.3.7.16.1 On K-148, press ENTR. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.16.2 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indication shall be between 77774 and 00003.

6.3.7.17 On K-148 Press VERB 33 ENTR. The GIMBAL LOCK lamp shall not be lighted. VERB 21, NOUN 22 is displayed flashing.

6.3.7.18 IMU CDU Fine Fail Test

6.3.7.18.1 On K-148 insert the following sequence

+00100 ENTR
+00100 ENTR
+00100 ENTR
On Event Module verify that ISS WARNING lamp lights.

6.3.7.18.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display Row 1 indicates 33XXX or 32XXX.

6.3.7.19 IMU CDU Coarse Fail Test

6.3.7.19.1 On K-148 insert the following sequence

VERB 33 ENTR
+03750 ENTR
+03750 ENTR
+03750 ENTR
Verify that ISS WARNING lamp Event Module lights.

6.3.7.19.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display of Row 1 indicates 33XXX or 32XXX.

6.3.7.20 FDAI Linearity Test

6.3.7.20.1 On K-148 enter VERB 33 ENTR
VERB 33 NOUN 27 shall be displayed.

6.3.7.20.2 On CRT verify the following:

PITCH ATT ERROR is between +15.3 and +18.7 DEG (GG2219)
YAW ATT ERROR is between +15.3 and +18.7 DEG (GG2249)
ROLL ATT ERROR is between +15.3 and +18.7 DEG (GG2279)

6.3.7.20.3 On K-148 press ENTR.
VERB 33 NOUN 90 shall be displayed.

6.3.7.20.4 On CRT verify the following:

PITCH ATT ERROR is between +14.4 and +17.6 DEG (GG2219)
YAW ATT ERROR is between +14.4 and +17.6 DEG (GG2249)
ROLL ATT ERROR is between +14.4 and +17.6 DEG (GG2279)

6.3.7.20.5 On K-148 press ENTR.
VERB 33 NOUN 31 shall be displayed

6.3.7.20.6 On CRT verify the following:

PITCH ATT ERROR is between +05.4 and +06.6 DEG (GG2219)
YAW ATT ERROR is between +05.4 and +06.6 DEG (GG2249)
ROLL ATT ERROR is between +05.4 and +06.6 DEG (GG2279)

6.3.7.20.7 On K-148 press ENTR.
VERB 33 NOUN 32 shall be displayed.

6.3.7.20.8 On CRT verify the following:

PITCH ATT ERROR is between +00.2 and -00.2 DEG (GG2219)
YAW ATT ERROR is between +00.2 and -00.2 DEG (GG2249)
ROLL ATT ERROR is between +00.2 and -00.2 DEG (GG2279)

6.3.7.20.9 On K-148 press ENTR.

VERB 33 NOUN 33 shall be displayed.

6.3.7.20.10 On CRT verify the following:

PITCH ATT ERROR is between -05.4 and -06.6 DEG (GG2219)
YAW ATT ERROR is between -05.4 and -06.6 DEG (GG2249)
ROLL ATT ERROR is between -05.4 and -06.6 DEG (GG2279)

6.3.7.20.11 On K-148 press ENTR.
VERB 33 NOUN 34 shall be displayed.

6.3.7.20.12 On CRT verify the following:

PITCH ATT ERROR is between -14.4 and -17.6 DEG (GG2219)
YAW ATT ERROR is between -14.4 and -17.6 DEG (GC2249)
ROLL ATT ERROR is between -14.4 and -17.6 DEG (GG2279)

6.3.7.20.13 On K-148 press ENTR.
VERB 33 NOUN 35 shall be displayed.

6.3.7.20.14 On CRT verify the following:

PITCH ATT ERROR is between -15.3 and -18.7 DEG (GG2219)
YAW ATT ERROR is between -15.3 and -18.7 DEG (GG2249)
ROLL ATT ERROR is between -15.3 and -18.7 DEG (GG2279)

6.3.7.21 On K-148 enter VERB 36 ENTR.
The proper operation of the IMU CAGE function (consisting of steps 6.3.7.21 thru 6.3.7.23) need be performed only once during the initial PGNCS Operational Test and omitted from subsequent testing of test 6.3.7.

6.3.7.21.1 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00500 ENTR
+00500 ENTR
+00500 ENTR

6.3.7.21.2 On the CRT, verify all IMU gimbal angles indicate between 003 and 007 DEG.

6.3.7.21.3 On analog recorder, monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps

6.3.7.21.4 Start analog recorder to a chart speed of 5 mm/sec.

6.3.7.21.5 On LEM Cabin Panel 4, hold IMU CAGE momentary toggle switch in the ON position. (Do not release).

6.3.7.21.6 On analog recorder, verify the 1X Resolver Sine signals (GG2112, GG2172, GG2142) null out to less than 0.5 VRMS. Release IMU CAGE switch to the OFF position. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Any sustained oscillations shall be cause for immediate removal of IMU Operate power.

6.3.7.21.7 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.7.22 Stop analog recorder.

6.3.7.23 On K-148 enter the following sequence:

VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00700 ENTR
+00700 ENTR
+00700 ENTR

6.3.7.24 On CRT verify the following:
IG 1X Resolver Sin (11°) is between +05.5 and 06.5 DEG (GG2121)
MG 1X Resolver Sin (11°) is between +05.5 and 06.5 DEG (GG2151)
OG 1X Resolver Sin (11°) is between +05.5 and 06.5 DEG (GG2181)

6.3.7.25 On K-148 enter the following:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.8 IRIG Scale Factor Determination

6.3.8.1 Insure that the IMU Operate power and LGC Operate power have been applied for a minimum of one hour and that the IMU is not in a gimbal lock condition.

6.3.8.2 On meter module monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.8.3 On K-148 enter the following sequence:

VERB 37 ENTR
00005 ENTR

6.3.8.4 PROG 07 shall be displayed.

6.3.8.5 VERB 06 NOUN 61 shall flash.

6.3.8.6 On the CRT DSKY, Verify contents of Row 1 (Navigation Base azimuth) and Row 2 (Site latitude shall be displayed).

6.3.8.7 If values for Row 1 and Row 2 are correct, proceed to the next step.
If values for Row 1 and Row 2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR
±xxxxx ENTR (Correct navigation base azimuth)
[illegible] ENTR (Correct site latitude)
Verify values in Row 1 and Row 2 are correct.

6.3.8.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.6.

6.3.8.9 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (-X IRIG Scale Factor error in part per million, Position +00001)

6.3.8.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.10.

6.3.8.11 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (-Y IRIG Scale Factor error in parts per million, Position +00002).

6.3.8.12 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.12.

6.3.8.13 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position +00003).

6.3.8.14 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 8.3.8.7 and 6.3.8.14.

6.3.8.15 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row (+X IRIG Scale Factor error in parts per million, Position -00001).

6.3.8.16 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.16.

6.3.8.17 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor error in parts per million, Position -00002).

6.3.8.18 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 31 NOUN 30 shall flash)
-00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM is ON, enter VERB 36 ENTR and repeat steps, 8.3.8.3 through 8.3.8.7 and 6.3.8.18.

6.3.8.19 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (-Z IRIG Scale Factor error in parts per million, Position -00003).

6.3.8.20 Repeat steps 6.3.8.8 through 6.3.8.19 twice to obtain second and third set of data.

6.3.8.21 Terminate this test by entering in K-148 the following:

VERB 34 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.8.22 The average of the three readings of Scale Factor Error for each of the 6 positions shall be 0 ± 1750 PPM.

6.3.9 IMU Performance Test. A reference data sheet is provided at the end of this section to aid in data reduction. [illegible] the start of this test.

6.3.9.1 Insure that IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.9.2 On CRT display, monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.9.3 Adjust oscilloscope to display butterfly of X PIPA.

6.3.9.4 On K-148 enter the following:

VERB 01 NOUN 10 ENTR
00003 ENTR
Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.9.5 On K-148 enter the following:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 01 ENTR
01300 ENTR
Record CRT DSKY Row 1 indications as ±BBBBB.

6.3.9.6 Perform the following calculations:

a. $$\frac{\text{BBBBB} \times 5.12}{360} = \text{CCCC.C}$$ (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours.

c. DDDD.D + present time of day = time of day at which high order scalar register will overflow.

6.3.9.7 If the time of day is within 12 minutes of that calculated in 6.3.9.6.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.9.6.c has passed and proceed.

Paragraph

6.3.9.15
6.3.9.22
6.3.9.30
6.3.9.36
6.3.9.43
6.3.9.48

6.3.9.8 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTR
00370 ENTR
Record contents of CRT DSKY Row 1 XXXXY
VERB 21 NOUN 01 ENTR
00370 ENTR
XXXXY' ENTR
Where Y' is obtained from Table 1a.
VERB 57 ENTR
00001 ENTR
VERB 06 NOUN 61 shall flash

6.3.9.9 On the CRT, DSKY display verify R1 (Navigation Base Azimuth) and R2 (Site Latitude) are correct.

6.3.9.10 If values for R1 and R2 are correct, proceed to next step.
If values for R1 and R2 are incorrect, enter the following sequence into K-148.

VERB 24 ENTR
±xxx.xx ENTR (Correct navigation base azimuth ±0.50 deg)
+40.748 ENTR (Correct site latitude)
Verify values in R1 and R2 are correct.

6.3.9.11 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.12 On CRT, DSKY display, verify R1 = +00600 (Time), R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position). If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00600 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00001 ENTR (Test Position Entry)

6.3.9.13 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.14 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 (+NBDY Position +00001).

6.3.9.15 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.16 After 100 seconds, take a photograph of Y and Z PIPA butterfly patterns on oscilloscope.

6.3.9.17 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (+X PIPA Position +00001). Row 1 is whole part, Row 2 is fractional part. Units are cm/sec^2.

6.3.9.18 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.19 On CRT, DSKY display - verify R1 = +00600, R2 = +00000, and R3 = +00002.

6.3.9.20 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.21 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDZ Position +00002).

6.3.9.22 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.23 Approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (-X PIPA Position +00002).

6.3.9.24 On K-148 enter the following sequence:

VERB 33 ENTR
Record CRT CDU gimbal angle indications and time.

6.3.9.25 In approximately 67 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDX + ADIAX Pos +00002). Record CRT CDU gimbal angle indications and time.

6.3.9.26 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.27 On CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00003.

6.3.9.28 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.29 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX Position +00003).

6.3.9.30 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.31 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Z PIPA Position +00003).

6.3.9.32 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.33 On the CRT, DSKY display verify R1 = +00600, R2 = 00000, and R3 = +00004.

6.3.9.34 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.35 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDY + ADSRAY Position +00004).

6.3.9.36 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.37 After 100 seconds, take a photograph of the X-PIPA butterfly pattern on oscilloscope.

6.3.9.38 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (-Z PIPA Position +00004).

6.3.9.39 On K-148 enter the following sequence:

VERB 33 ENTR

Record CRT CDU gimbal angle indications and time.

6.3.9.40 In approximately 67 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display record R2 (+NBDZ + ADIAZ Position +00004). Record CRT CDU gimbal angle indications and time.

6.3.9.41 On K-148 enter the following sequence:

VERB 33	ENTR
VERB 06	NOUN 66 shall flash

6.3.9.42 From the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00005.

6.3.9.43 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.44 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.45 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Y PIPA Position +00005).

6.3.9.46 On K-148 enter the following sequence:

VERB 34	ENTR
VERB 06	NOUN 66 shall flash

6.3.9.47 On the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00006.

6.3.9.48 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.49 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.50 In approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2. (-Y PIPA Position +00006).

6.3.9.51 On K-148 enter the following sequence:

VERB 34	ENTR
VERB 06	NOUN 66 shall flash

6.3.9.52 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000 and R3 = +00007.

6.3.9.53 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.54 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+.707 ADSRAX-NBDX Position +00007).

6.3.9.55 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.56 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00008.

6.3.9.57 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.58 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 [-.707 (NBDZ+NBDY) +0.5 (ADIAZ - ADIAY) +0.5 (ADSRAY + ADSRAZ)] (Position + 00008).

6.3.9.59 On K-148 enter the following:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.60 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00009.

6.3.9.61 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.62 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display, record R2 (-NBDZ + .707 ADSRAZ Position +00009).

6.3.9.63 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.64 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00010.

6.3.9.65 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.66 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 [.707 (NBDY-NBDX) +.5 (ADIAY - ADIAX) +.5 ADSRAX] (Position +00010).

6.3.9.67 Terminate this test by entering in K-148 the following:

VERB 36 ENTR

6.3.9.68 On CRT, record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).

6.3.9.69 On K-148 enter the following sequence:
VERB 41 NOUN 20 ENTER
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.9.70 Calculations

NOTE: Use Post Vibration or System Test data points only.

6.3.9.70.1 Obtain data from last IRIG and/or PIPA test and fill in Data Sheet x_{i-1}.

6.3.9.70.2 Obtain data from second last IRIG and/or PIPA test and fill in Data Sheet x_{i-2}.

6.3.9.70.3 Obtain data from third last IRIG and/or PIPA test and fill in Data Sheet x_{i-3}.

6.3.9.70.4 Perform the following calculations for each item appearing on Data Sheet x_i and transfer all results to lines au through bi.

NOTE:

See paragraph 5.6 before continuing

$$D_1 = \left| x_{i-1} - x_i \right|$$

$$D_2 = \left| x_{i-1} - x_i \right| + \left| x_{i-2} - x_{i-1} \right|$$

$$D_3 = \left| x_{i-3} - x_{i-2} \right| + \left| x_{i-2} - x_{i-1} \right| + \left| x_{i-1} - x_i \right|$$

6.3.10 LGC Voltage Margin Test

6.3.10.1 Initial Conditions

6.3.10.1.1 Insure that the G&N System is in the Standby Mode.

6.3.10.1.2 On the CRT, verify the +28 VDC LGC OPERATE bus is between 24.5 and 33.5 vdc (GG 1520).

6.3.10.2 Voltage Margin Determination

6.3.10.2.1 On the PSA Adapter Module (PSAAM) (410-31080), place INHIBIT VOLTAGE FAIL switch to ON.

> CAUTION: The +4 vdc LGC Supply voltage shall never be operated lower than +2.5 vdc or higher than +5.2 vdc (GG1030).
>
> The +14 vdc LGC Supply shall never be operated less than +8.5 vdc or higher than +17.0 vdc (GG 1020).
>
> NOTE: The flashing indication of the LGC supplies may be disregarded for this test. The charts in Table II may be used to determine approximate values for "XX. X" values of C-156 voltage dial settings corresponding to various power supply voltages.

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9. 14	+N BDY Position +00001 Transfer result to line af	meru	( ) ---.--	a.
6.3.9. 17	+X PIPA Test Position +00001	cm/sec^2	( ) 00---. ( )-----	b.
6.3.9. 21	+N BDZ Position +00002 Transfer result to line ag	meru	( ) ---.--	c.
6.3.9. 23	-X PIPA Test Position +00002	cm/sec^2	( ) 00---. ( )-----	d.
6.3.9. 25	-N BDX + ADIAX Position +00002	meru	( ) ---, --	e.
6.3.9. 29	-N BDX Position +00003 Multiply by -1 and transfer result to line ah	meru	( ) ---.--	f.
6.3.9. 31	+Z PIPA Test Position +00003	cm/sec^2	( ) 00---. ( ) -----	g.
6.3.9. 35	+N BDY + ADSRAY Position +00004	meru	( ) ---.--	h.
6.3.9. 38	-Z PIPA Test Position +00004	cm/sec^2	( ) 00---. ( ) -----	i.
6.3.9. 40	+N BDZ + ADIAZ Position +00004	meru	( ) ---.--	j.
6.3.9. 45	+Y PIPA Test Position +00005	cm/sec^2	( ) 00---. ( ) -----	k.
6.3.9. 50	-Y PIPA Test Position +00006	cm/sec^2	( ) 00---. ( ) -----	l.

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9.54	-NBDX+ .707 ADSRAX Position +00007	meru		m.
6.3.9.58	-.707 (NBDZ+NBDY) +0.5 (ADIAZ-ADIAY) +0.5 (ADSRAY+ADSRAZ) Position +00008	meru		n.
6.3.9.62	-NBDZ+.707ADSRAZ Position +00009	meru		o.
6.3.9.66	.707(NBDY-NBDX) +.5 (ADIAY-ADIAX) +.5 ADSRAX Position +00010	meru		p.

DATA SHEET

CALCULATION	PARAMETER	UNITS	
line c - line f = ( ) ---.-- (-NBDX+ADIAX) - (-NBDX) Transfer result to line al.	ADIAX	meru	q
line h - line a = ( ) ---.-- (+NBDY+ADSRAY) - (+NBDY) Transfer result to ai.	ADSRAY	meru	r
line j - line c = ( )---.--- (+NBDZ+ADIAZ) - (NBDZ) Transfer result to line am.	ADIAZ	meru	s
(line m - line f)X1.414 = ( ) ---.-- [(-NBDX + .707 ADSRAX) - (-NBDX)] X 1.414 Transfer result to line ak.	ADSRAX	meru	t
(line e + line c) X1.414 = ( ) ---.-- (-NBDZ + .707 ADSRAZ + NBDZ) X1.414 Transfer result to line ai.	ADSRAZ	meru	u
(line p - .707 line a - .707 line f +.5 line q -.5 line t) X2 = ---.-- [.707 (NBDY-NBDX) +.5 (ADIAY-ADIAX) +.5 ADSRAX -.707 (-NBDX) -.707 NBDY +.5 ADIAX-.5 ADSRAX] X2 Transfer result to line an.	ADIAY	meru	v
line b - line d = ( )	PIPA X2G	cm/sec^2	w
line k - line l = ( )	PIPA Y2G	cm/sec^2	x
line g - line i = ( )	PIPA Z2G	cm/sec^2	y
1960.52 ÷ line w x 1 cm/sec/pulse = Subtract this value from 1.000000 multiply x 10^6 and transfer results to line ao.	X PIPA S. F.	cm/sec/pulse	z
1960.52 ÷ line x X 1 cm/sec/pulse = Subtract this value from 1.000000 multiply x 10^6 and transfer results to line ap.	Y PIPA S. F.	cm/sec/pulse	aa
1960.52 ÷ line y X 1 cm/sec/pulse = Subtract the value from 1.000000 multiply x 10^6 and transfer results to line aq.	Z PIPA S. F.	cm/sec/pulse	ab
1/2 (line b + line d) = ( ) --.-- Transfer results to line ar	X PIPA Bias	cm/sec^2	ac
1/2 (line k + line l) = ( ) --.--- Transfer results to line as	Y PIPA Bias	cm/sec^2	ad
1/2 (line g + line i) = ( ) --.--- Transfer results to line at	Z PIPA Bias	cm/sec^2	ae

TABLE I

Y	Y'
0	2
1	3
2	2
3	3
4	6
5	7
6	6
7	7

DATA SHEET
(x_1)

PARAMETER	UNITS	MIN VALUE	RECORDED VALUE	MAX VALUE	REJ	ACC	
NBDY	meru	-15		+15			af
NBDZ	meru	-15		+15			ag
NBDX	meru	-15		+15			ah
ADSRAY	meru	-40		+40			ai
ADSRAZ	meru	-40		+40			aj
ADSRAX	meru	-40		+40			ah
ADIAX	meru	-100		+100			al
ADIAZ	meru	-100		+100			am
ADIAY	meru	-100		+100			an
X PIPA S. F. error from line z	PPM	-2000		+2000			ao
Y PIPA S. F. error from line aa	PPM	-2000		+2000			ap
Z PIPA S. F. error from line ab	PPM	-2000		+2000			aq
X PIPA Bias from line ac	cm/sec^2	-3.1		+3.1			ar
Y PIPA Bias from line ad	cm/sec^2	-3.1		+3.1			as
Z PIPA Bias from line ae	cm/sec^2	-3.1		+3.1			at

DATA SHEET
(x_{i-1})

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru	
ADSRAZ	meru	
ADSRAX	meru	
ADIAX	meru	
ADIAZ	meru	
ADIAY	meru	
X PIPA S. F. error	PPM	
Y PIPA S. F. error	PPM	
Z PIPA S. F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET
(x_1-2)

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru	
ADSRAZ	meru	
ADSRAX	meru	
ADIAX	meru	
ADIAZ	meru	
ADIAY	meru	
X PIPA S. F. error	PPM	
Y PIPA S. F. error	PPM	
Z PIPA S. F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET
(x_{1-3})

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru	
ADSRAZ	meru	
ADSRAX	meru	
ADIAX	meru	
ADIAZ	meru	
ADIAY	meru	
X PIPA S. F. error	PPM	
Y PIPA S. F. error	PPM	
Z PIPA S. F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET

PARAMETER	UNITS	D_1	MAX	D_2	MAX	D_3	MAX	
NBDY	meru		6		9		11	au
NBDZ	meru		6		9		11	av
NBDX	meru		6		9		11	aw
ADSRAY	meru		14		21		25	ax
ADSRAZ	meru		14		21		25	ay
ADSRAX	meru		14		21		25	az
ADIAX	meru		17		33		40	ba
ADIAZ	meru		17		33		40	bb
ADIAY	meru		17		33		40	bc
X PIPA S. F.	Error PPM		400		500		600	bd
Y PIPA S. F.	Error PPM		400		500		600	be
Z PIPA S. F.	Error PPM		400		500		600	bf
X PIPA Bias	cm/sec^2		0.5		0.7		0.9	bg
Y PIPA Bias	cm/sec^2		0.5		0.7		0.9	bh
Z PIPA Bias	cm/sec^2		0.5		0.7		0.9	bi

6.3.10.2.2 Enter 0001 into R155. Verify and execute.

6.3.10.2.3 Enter 1111 into R154. Verify and execute.

6.3.10.2.4 Enter in C-156 ±XX. X001114. (Enter a value for XX. X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 12.1 (+0.3, −0) vdc. See Table II). Execute.

6.3.10.2.5 Enter in C-156 ±XX. X001124 (Enter a value for XX. X which will adjust the +4V power supply (GG 1030) as monitored on the CRT, to 3.5 (+0.15, −0) vdc. See Table II). Execute.

6.3.10.2.6 On K-148 press ERROR RESET.

6.3.10.2.7 On K-148 initiate LGC Self-Check by entering the following:

VERB 21 NOUN 27 ENTR
77767 ENTR

Wait 200 seconds. Verify RESTART lamp on the DSKY is not lit.

6.3.10.2.8 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.9 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations.

VERB 21 NOUN 27 ENTR
77767 ENTR

6.3.10.2.10 Enter in C-156 (±) XX. X001114 (Enter a value for XX. X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 16.4 (+0, −0.4) vdc. See Table II. Execute.

6.3.10.2.11 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.12 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations.

VERB 21 NOUN 27 ENTR
77767 ENTR

6.3.10.2.13 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the 4V power supply (GG 1030) as monitored on the CRT, to 4.5 (+0, -0.2) vdc. See Table II). Execute.

6.3.10.2.14 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.

6.3.10.2.15 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lit. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:

```
VERB 21 NOUN 27 ENTR
77767           ENTR
```

6.3.10.2.16 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the 14V power supply (GG 1020) as monitored on the CRT, to 12.1 (+0.3, -0) vdc. See Table II). Execute.

6.3.10.2.17 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.18 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.19 On R-154 enter 0000. Execute.

6.3.10.2.20 On R-155 enter 0000. Execute.

6.3.10.2.21 On K-148 terminate the LGC Self-Check by entering the following:

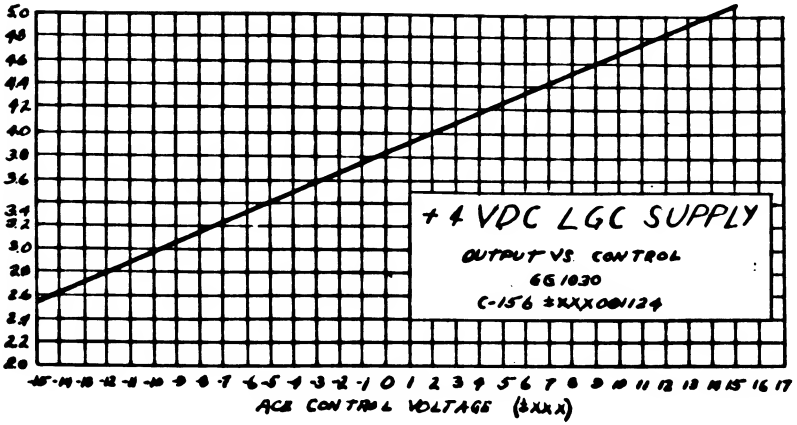
```
VERB 21  NOUN 27  ENTR
00000             ENTR
```

6.3.10.2.22 On K-148 press ERROR RESET.

6.3.11 LGC Clock Frequency Test

6.3.11.1 Insure that LGC Operate power has been applied for a minimum of 10 minutes before performing this test.

6.3.11.2 Verify that the counter is connected to the 3.2kc signal on the hardline.


+4 VDC LGC SUPPLY
OUTPUT VS CONTROL
6G 1030
C-156 #XXX001124
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
ACE CONTROL VOLTAGE (±XX.X)

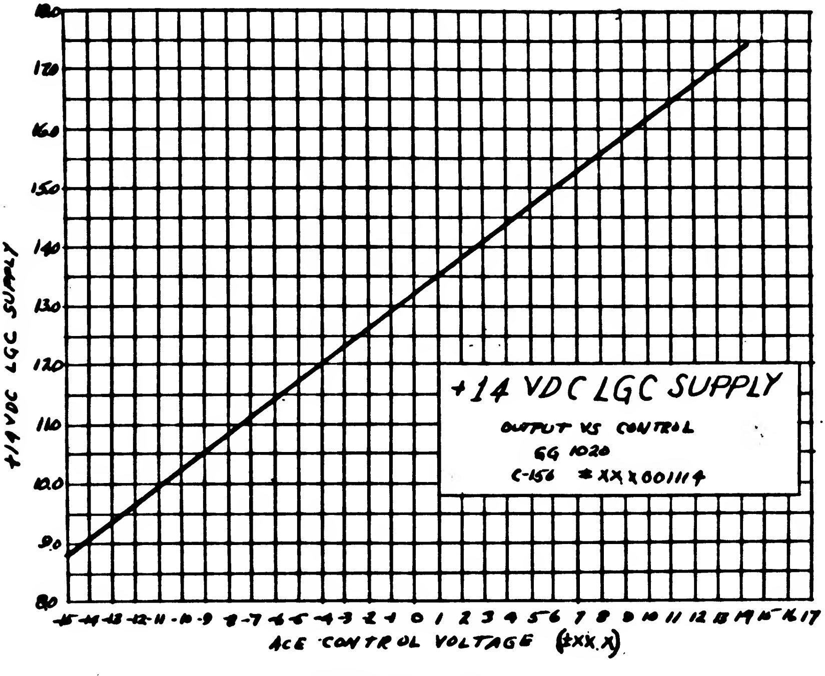

+14 VDC LGC SUPPLY
OUTPUT VS CONTROL
6G 1020
C-156 #XXX001114
+14 VDC LGC SUPPLY
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
ACE CONTROL VOLTAGE (±XX.X)

TABLE II

6.3.11.3 Insure that the counter has been warming up for a minimum of 30 minutes.

6.3.11.4 On the counter,

Set the FUNCTION switch to: MAN START
Set the TIME BASE switch to: 1 μs TIME UNIT/COUNT
Set the SENSITIVITY control to: CHECK

6.3.11.5 Verify proper counter operation.

6.3.11.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.

6.3.11.7 Plug in the Preset unit and set:

MODE switch to PRESET
N switches to 96000

6.3.11.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.

6.3.11.9 Start counting by depressing RESET switch on counter.

6.3.11.10 After approximately 30 seconds, read and record counter display.

6.3.11.11 Repeat steps 6.3.11.9 and 6.3.11.10 9 times.

6.3.11.12 The average of the 10 previous readings shall be 30.000000±0.000060 seconds.

6.3.11.13 Insure that the System is not in IMU Operate.

6.3.11.14 Perform the following DSKY operations.

VERB 21	NOUN 10	ENTR
00013		ENTR
02000		ENTR

Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is lighted.

6.3.11.15 Repeat steps 6.3.11.9 through 6.3.11.12.

6.3.11.16 Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is not lighted.

6.3.11.17 On the Computer Control and Reticle dimmer assembly, press and hold MARK X pushbutton.

6.3.11.18 On the DSKY observe

VERB 05 NOUN 31
Row 1 = 00112
Prog Alarm lamp is lighted
Press Error Reset

6.3.11.19 Enter the following on K-148

VERB 11 NOUN 10 ENTR
00016 ENTR

6.3.11.20 Observe that DSKY Row 1 displays 00004.

6.3.11.21 Release MARK X pushbutton

6.3.11.22 Observe that DSKY Row 1 displays 00000.

6.3.11.23 Press and hold the MARK Y pushbutton on the Computer Control and Reticle Dimmer Assembly.

6.3.11.24 Observe that DSKY Row 1 displays 00010.

6.3.11.25 Release MARK Y pushbutton.

6.3.11.26 Observe that DSKY Row 1 displays 00000.

6.3.11.27 Press and hold the REJECT pushbutton on the Computer Control and Reticle Dimmer Assembly.

6.3.11.28 Observe that DSKY Row 1 displays 00020.

6.3.11.29 Release the REJECT pushbutton.

6.3.11.30 Observe that DSKY Row 1 displays 00000.

6.3.11.31 On the DSKY perform the following operation

VERB 36 ENTR

6.3.11.32 On the Computer Control and Reticle dimmer assembly, rotate the RETICLE BRIGHTNESS control to its minimum light intensity position. View through the AOT and verify that the reticle lamp is off.

6.3.11.33 While viewing through the AOT, slowly rotate the RETICLE BRIGHTNESS control to increase the reticle brightness until a stop is reached. Observe that the reticle brightness has increased in intensity. Return RETICLE BRIGHTNESS control to off state.

6.3.11.34 AOT eyepiece Heater Test.

6.3.11.34.1 Secure milliameter HP 428B and current probe HP428A-21A.

6.3.11.34.2 Locate P1 at Computer Control and Reticle Dimmer assembly. Push lacing cord away from P1 back to fifth tie point.

6.3.11.34.3 Clip current probe HP428A-21A to blue wire in cable with red arrow pointing away from P1. Measure and record current indication. The current shall be between 139 and 244 ma.

6.3.11.34.4 Remove current probe, push lacing cord back to P1 and spot tie.

6.3.12 Gimbal Friction Test

6.3.12.1 Inner Gimbal Friction Test

6.3.12.1.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.12.1.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.1.3 Set up Analog Recorder to monitor the following signals:

MEAS. NO.	SIGNAL NAME
a. GG2110	IG Torque Motor Current
b. GG2106	IG Servo Error Total
c. GG2107	IG Servo Error In Phase
d. GG2112	IG 1x Resolver Sine
e. GG2113	IG 1x Resolver Cosine
f. GG2220	IG CDU Fine Error
g. GG1201	IMU 28V 1% 800 CPS

6.3.12.1.4 Set up Analog Recorder to monitor the following signals:

MEAS. NO.	SIGNAL NAME
a. GG2300	PIPA TEMP
b. GG2301	IRIG TEMP
c. GG1520	+28 VDC LGC OPR BUS

6.3.12.1.5 After 10 seconds has elapsed since step 6.3.12.1.1, enter the following into K-148.

VERB 21 NOUN 01 ENTR
00403 ENTR
00000 ENTR

6.3.12.1.6 Verify on CRT, DSKY display

VERB 21 NOUN 01
R1 = 00000
R3 = 00403

6.3.12.1.7 On K-148 enter the following sequence:

NOUN 15 ENTR
00000 ENTR ENTR (Push ENTR pushbutton twice)
Verify R1 = +00000
37777 ENTR ENTR
Verify R1 = 37777
37743 ENTR ENTR
Verify R1 = 37743

00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR (once)
Verify R1 = 00000

6.3.12.1.8 Start analog recorders using a chart speed of 10 mm/sec (IG - 360° TORQUE)

6.3.12.1.9 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTR
00370 ENTR
Record contents of CRT DSKY Row 1 xxxxY
VERB 21 NOUN 01 ENTR
00370 ENTR
XXXXY' ENTR
Where Y' is obtained from Table 1.
VERB 42 ENTR
VERB 33 ENTR

6.3.12.1.10 Monitor analog recorder. When the IG Torque Motor Current signal (GG2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.1.11 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.12.1.12 On the CRT, verify CDU X, CDU Y, CDU Z all indicate +00000 (±00200).

6.3.12.1.13 After 10 seconds has elapsed since step 6.3.12.1.11 enter the following sequence into K-148:

VERB 21 NOUN 01 ENTR
00403 ENTR
00000 ENTR

6.3.12.1.14 Verify on CRT, DSKY display

VERB 21 NOUN 01
R1 00000
R3 00403

6.3.12.1.15 On K-148 enter the following sequence:

NOUN 15 ENTR
00000 ENTR ENTR (Press ENTR pushbutton twice)
Verify R1 = 00000
40000 ENTR ENTR
Verify R1 = 400000
40034 ENTR ENTR
Verify R1 = 40034
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR (once)
Verify R1 = 00000

6.3.12.1.16 Start analog recorders using a chart speed of 10 mm/sec (IG +360° TORQUE)

6.3.12.1.17 On K-148 enter the following sequence

VERB 42 ENTR
VERB 33 ENTR

6.3.12.1.18 Monitor analog recorder. When the IG Torque Motor Current signal (GG2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.2 Outer Gimbal Friction Test

6.3.12.2.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR. Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.12.2.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.3 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2167	OG Servo Error In Phase
b. GG2170	OG Torque Motor Current
c. GG2166	OG Servo Error Total
d. GG2280	OG CDU Fine Error
e. GG2172	OG 1x Resolver Sine
f. GG2173	OG 1x Resolver Cosine

6.3.12.2.4 After 10 seconds has elapsed since step 6.3.12.2.1 enter the following sequence into K-148:

VERB 21 NOUN 01 ENTR
00403 ENTR
37777 ENTR

6.3.12.2.5 Verify on CRT, DSKY display

VERB 21 NOUN 01
R1 37777
R3 00403

6.3.12.2.6 On K-148 enter the following sequence:

NOUN 15 ENTR
377438 ENTR ENTR (Press ENTR pushbutton twice)
Verify R1 = 37743
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR (once)
Verify R1 = 00000

6.3.12.2.7 Start analog recorders using a chart speed of 10 mm/sec. (OG - 360° TORQUE)

6.3.12.2.8 On K-148 enter the following sequence:

```
VERB 42   ENTR
VERB 33   ENTR
```

6.3.12.2.9 Monitor analog recorder. When the OG Torque Motor Current signal (GG2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.2.10 On K-148 enter the following sequence:

```
VERB 40   NOUN 20   ENTR   Wait 3 seconds
VERB 41   NOUN 20   ENTR
+00000    ENTR
+00000    ENTR
+00000    ENTR
```

6.3.12.2.11 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.12 After 10 seconds has elapsed since step 6.3.12.2.10, enter the following sequence into K-148.

```
VERB 21   NOUN 01   ENTR
00403     ENTR
40000     ENTR
```

6.3.12.2.13 Verify on CRT, DSKY display.

```
VERB 21   NOUN 01
R1        40000
R3        00403
```

6.3.12.2.14 On K-148 enter the following sequence:

```
NOUN 15       ENTR
40034         ENTR     ENTR
Verify R1 =   40034
00000         ENTR     ENTR
Verify R1 =   00000
00000         ENTR     ENTR
Verify R1 =   00000
00000         ENTR     ENTR
Verify R1 =   00000
00000         ENTR     (once)
Verify R1 =   00000
```

6.3.12.2.15 Start analog recorders using a chart speed of 10 mm/sec (OG +360° TORQUE)

6.3.12.2.16 On K-148 enter the following sequence

VERB 42	ENTR
VERB 33	ENTR

6.3.12.2.17 Monitor analog recorder. When the OG Torque Motor Current signal (GG2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.3 Middle Gimbal Friction Test

6.3.12.3.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+06750	ENTR		

6.3.12.3.2 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = +06750±00200.

6.3.12.3.3 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2136	MG Servo Error Total
b. GG2137	MG Servo Error In Phase
c. GG2150	MG Torque Motor Current
d. GG2143	MG 1x Resolver Cosine
e. GG2250	MG CDU Fine Error
f. GG2142	MG 1x Resolver Sine

6.3.12.3.4 After 10 seconds have elapsed since step 6.3.12.3.1, enter the following sequence into K-148:

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.3.5 Verify on CRT, DSKY display

VERB 21	NOUN 01
R1 =	00000
R3 =	00403

6.3.12.3.6 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR (Press ENTR pushbutton twice)
Verify R1 =	00000	
00000	ENTR	ENTR
Verify R1 =	00000	
00000	ENTR	ENTR
Verify R1 =	00000	
14000	ENTR	ENTR
Verify R1 =	14000	
00000	ENTR	(once)
Verify R1 =	00000	

6.3.12.3.7 Start analog recorders using a chart speed of 10 mm/sec. (MG - 135° TORQUE)

6.3.12.3.8 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.3.9 Monitor analog recorder. When MG Torque Motor Current (GG2140) drops to a quiescent level (approximately 6 minutes), stop the recorders.

6.3.12.3.10 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
-06750	ENTR		

6.3.12.3.11 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = -06750±00200.

6.3.12.3.12 After 10 seconds has elapsed since step 6.3.12.3.10, enter the following sequence into K-148:

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.3.13 On the CRT, DSKY display verify:

VERB 21	NOUN 01
R1 =	00000
R3 =	00403

6.3.12.3.14 On K-148 enter the following sequence:

NOUN 15	ENTR		
00000	ENTR	ENTR	(Press ENTR pushbutton twice)
Verify R1 =	00000		
00000	ENTR	ENTR	
Verify R1 =	00000		
00000	ENTR	ENTR	
Verify R1 =	00000		
63777	ENTR	ENTR	
Verify R1 = 6	63777		
77777	ENTR	(once)	
Verify R1 =	77777		

6.3.12.3.15 Start analog recorders using a chart speed of 10 mm/sec. (MG +135° TORQUE)

6.3.12.3.16 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.3.17 Monitor analog recorder. When the MG Torque Motor Current signal (GG2140) drops to a quiescent level (approximately 6 minutes) stop the recorders.

6.3.12.3.18 On K-148 enter the following sequence:

VERB 41	NOUN 20	ENTR
+00000	ENTR	
+00000	ENTR	
+00000	ENTR	

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6.3.12.4 Test Analysis

6.3.12.4.1 Remove the strip charts from analog recorders

6.3.12.4.2 Examine each trace carefully to detect any sharp discontinuities of the traces. Disregard all transients less than 0.5 second (5 mm) on any Torque Motor Current signal. Disregard all transients less than 0.2 second (2 mm) on any CDU Fine Error signal.

6.3.12.4.3 No Torque Motor Current signal on (GG2140, GG2170, GG2110) shall ever exceed (0.125) amp. Sensitivity on recorder is 20 ma/division.

6.3.12.4.4 No CDU Fine Error on (GG2220, GG2280, GG2250) shall ever exceed (.070) volts. Sensitivity on recorder is 50 mv/division.

6.3.13 Stabilization Loop Step Response Test

6.3.13.1 IG Response Test

6.3.13.1.1 On K-148 enter the following sequence:

```
VERB 40     NOUN 20   ENTR    Wait 3 seconds
VERB 41     NOUN 20   ENTR
+00000      ENTR
+00000      ENTR
+00000      ENTR
```

6.3.13.1.2 On CRT, verify IG MG, and OG gimbal angles are between 358 and 002.

6.3.13.1.3 Set up analog recorder to monitor the following:

MEAS NO.	SIGNAL NAME
a. GG2110	IG Torque Motor Current
b. GG2106	IG Servo Error Total
c. GG2107	IG Servo Error In Phase
d. GG2112	IG 1X resolver Sine
e. GG2113	IG 1X Resolver Cosine
f. GG2220	IG CDU Fine Error
g. GG1201	IMU 28V 1 PCT 800 CPS

6.3.13.1.4 On K-148 initiate FINE ALIGN by entering the following sequence:

```
VERB 42     ENTR
+00000      ENTR
+00000      ENTR
+00000      ENTR
```

6.3.13.1.5 On the CRT verify CDU X, CDU Y and CDU Z indicate +00000±00200.

> CAUTION: If the transients caused by the subsequent step input do not damp out within 15 seconds, remove IMU Operate Power.

6.3.13.1.6 Enter 1000 into R-START 155.

6.3.13.1.7 Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the IG stabilization loop.

6.3.13.1.8 Prepare to start analog recorder at a chart speed of 100 mm/sec. (IG RESPONSE TEST)

6.3.13.1.9 Enter 0000 into R-START 155. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the IG stabilization loop.

6.3.13.1.10 After the transient on the recorder has died out, stop the recorder.

6.3.13.1.11 From the Servo Error In Phase signal recorder trace measure the time interval (T1, Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period T1, shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.

6.3.13.2 MG Response Test

6.3.13.2.1 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2136	MG Servo Error Total
b. GG2137	MG Servo Error in Phase
c. GG2140	MG Torque Motor Current
d. GG2143	MG 1X Resolver Cosine
e. GG2250	MG CDU Fine Error
f. GG2142	MG 1X Resolver Sine
g. GG1201	IMU 28V 1% 800 cps

6.3.13.2.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).

> CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU Operate power.

6.3.13.2.3 Enter 0100 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the MG stabilization loop.

6.3.13.2.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (MG RESPONSE TEST).

6.3.13.2.5 Enter 0000 into R-START 155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.

6.3.13.2.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.2.7 From the Servo Error In Phase signal recorder trace measure the time interval (T1 Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig 3). The period, T1, shall not exceed 0.1 seconds and the trace shall have no more than 3 overshoots.

6.3.13.3 OG Response Test

6.3.13.3.1 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2167	OG Servo Error In Phase
b. GG2170	OG Torque Motor Current
c. GG2166	OG Servo Error Total
d. GG2280	OG CDU Fine Error
e. GG2172	OG 1X Resolver Sine
f. GG2173	OG 1X Resolver Cosine
g. GG1201	IMU 28V 1% 800 cps

6.3.13.3.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).

CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU operate power.

6.3.13.3.3 Enter 0010 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the OG stabilization loop.

6.3.13.3.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (OG RESPONSE TEST).

6.3.13.3.5 Enter 0000 into R-155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the OG stabilization loop.

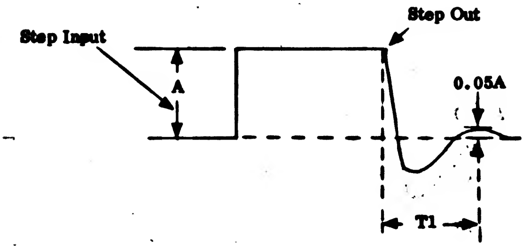
6.3.13.3.6 After the transient on the recorder has died out, stop the recorder.

'C

6.3.13.3.7 From the Servo Error In Phase signal recorder trace, measure the time interval (T1, Fig 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig 3). The period, T1, shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.

6.3.13.3.8 On K-148 enter the following sequence:

VERB 41	NOUN 20	ENTR
+00000	ENTR	
+00000	ENTR	
+00000	ENTR	



TYPICAL STAB LOOP RESPONSE TO STEP INPUT

FIGURE 3

6.3.14 G&N Fine Alignment Test

6.3.14.1 On K-148 enter:

VERB 01 NOUN 10 ENTR
00003 ENTR

6.3.14.2 Record CRT, DSKY Row 1 display as AAAAA and the time of day.

6.3.14.3 On K-148 enter:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 02 ENTR
01300 ENTR

6.3.14.4 Record CRT DSKY Row 1 display as ±BBBBB

6.3.14.5 Perform the following calculations:

a. $\frac{\text{BBBBBX } 5.12}{3600}$ = CCCC.C Contents of high order scalar register in hours.

b. 23.3 - CCCC.C = DDDD.D Time left in high order scalar register until overflow.

c. DDDD.D + time of day recorded in step 3 = time of day at which high order scalar register will overflow.

6.3.14.6 If the time of day is within 12 minutes of that time calculated in 6.3.14.5.c when about to complete step 6.3.14.30 wait until that time calculated in c has passed and then proceed.

NOTE: Use of Dioptemeter is required for all optical sightings using AOT.

6.3.14.7 On K-148 enter:

VERB 01 NOUN 01 ENTR
00370 ENTR
Record contents of DSKY Row 1 xxxxY
VERB 21 NOUN 01 ENTR
000370 ENTR
XXXXY' ENTR
Where Y' is obtained from Table 1a.
VERB 57 ENTR
00003 ENTR

6.3.14.8 Verify CRT DSKY display as:

VERB 06 NOUN 61 (Flashing
R1 = +13500 (SM Azimuth)
R1 = +40.748 (Site Latitude)

NOTE: If R1 and R2 indications are correct proceed to step 6.3.14.10.

6.3.14.9 On K-148 enter:

VERB 21	ENTR
+13500	ENTR
VERB 22	ENTR
+40748	ENTR

6.3.14.10 On K-148 enter:

VERB 33	ENTR	
Observe on CRT DSKY display		
VERB 21	NOUN 30	(Flashing)

6.3.14.11 On K-148 enter:

0000X	ENTER (Test position, either 1 or 2)
00000	ENTR (Use AOT)

Observe on CRT DSKY display:

VERB 06	NOUN 61	(Flashing)

Disregard Row 1, 2, and 3 indications

6.3.14.12 On K-148 enter:

VERB 21	ENTR
+XXX.XX	ENTR (L tgt. true azimuth from 6.3.15.1.14)
VERB 22	ENTR
+XXX.XX	ENTR (L tgt. elevation from 6.3.15.1.3)
VERB 23	ENTR
00001	ENTR (L tgt. number)
VERB 33	ENTR

Observe on CRT DSKY display:

VERB 06	NOUN 61	(Flashing)

Disregard Row 1, 2 and 3 indications.

6.3.14.13 On K-148 enter:

VERB 21	ENTR	
+XXX.XX	ENTR	(F tgt. true azimuth from 6.3.15.1.14)
VERB 22	ENTR	
+XXX.XX	ENTR	(F tgt. elevation from 6.3.15.1.12)
VERB 23	ENTR	
00002	ENTR	(F tgt. number)
VERB 33	ENTR	

Observe on CRT DSKY display:
VERB 51 (flashing)
R1 = 00001

6.3.14.14 On Computer Control and Reticle Dimmer Assembly, press MARK X pushbutton. Observe on DSKY display:

VERB 21 NOUN 30 (Flashing)

6.3.14.15 On DSKY press ENTR

Observe on DSKY display:

VERB 21 NOUN 42 (Flashing)

6.3.14.16 On DSKY enter:

00001 ENTR (L Detent Code)
Observe on DSKY display
VERB 21 NOUN 42 (Flashing)

6.3.14.17 Set AOT to "L" position

6.3.14.18 Rotate AOT control knob until the center of the L tgt reticle is super imposed between the double Y reticle. Record AOT counter value as LY XXX.XX.

6.3.14.19 Rotate AOT control knob until the center of the L tgt reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as LS XXX.XX.

6.3.14.20 On DSKY enter:

±XXX.XX ENTR (value of LY)
Observe on DSKY display:
VERB 22 NOUN 42 (Flashing)

6.3.14.21 On DSKY enter:

±XXX.XX ENTR (Value of LS)
Observe on DSKY display:
VERB 51 (Flashing)
R1 = 00002

6.3.14.22 On Computer Control and Reticle Dimmer Assembly, press MARK X pushbutton. Observe on DSKY display:

VERB 21 NOUN 30 (Flashing)

6.3.14.23 On DSKY press ENTR. Observe on DSKY display:

VERB 21 NOUN 43 (Flashing)

6.3.14.24 On DSKY enter:

00002 ENTR (F Detent Code)
Observe on DSKY display:
VERB 21 NOUN 42 (Flashing)

6.3.14.25 Set AOT to "F" position

6.3.14.26 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double Y reticle. Record AOT counter value as FY XXX.XX.

6.3.14.27 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as FS XXX.XX.

6.3.14.28 On DSKY enter:

±XXX.XX ENTR (value of FY)
Observe on DSKY display:
VERB 22 NOUN 42 (Flashing)

6.3.14.29 On DSKY enter:

±XXX.XX ENTR (value of FS)

NOTE: Wait until DSKY display indicates VERB 51 (Flashing) R1 = 00001 before proceeding.

NOTE: Before completing step 6.3.14.30 check time of day to verify that the high order scalar will not overflow within the next 12 minutes.

6.3.14.30 Repeat steps 6.3.14.14 through 6.3.14.29.

6.3.14.31 In approximately 7 minutes, observe on CRT DSKY display and record.

VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Where number part of Y_{sm} misalignment about Z_{sm})
R2 = .XXXXX (Fractional number part of Y_{sm} misalignment about Z_{sm}.)

6.3.14.32 On K-148 enter.

VERB 33 ENTR
Observe on CRT DSKY display and record:
VERB 06 NOUN 66 (Flashing)

R1 = XXXXX (Whole number part of Z_{sm} misalignment about Y_{sm})
R2 = .XXXXX (Fractional number part of Z_{sm} misalignment about Y_{sm})

6.3.14.33 On K-148 enter:

VERB 36 ENTR
Press ERROR RESET

6.3.14.34 Repeat steps 6.3.14.7 through 6.3.14.30.

6.3.14.35 In approximately 7 minutes, observe on CRT DSKY display and record:

VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Whole number part of X_{sm} misalignment about Y_{sm})
R2 = .XXXXX (Fractional number part of X_{sm} misalignment about Y_{sm})

6.3.14.36 On K-148 enter:

VERB 33 ENTR
Observe on CRT DSKY display and record:
VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Whole number part of Y_{sm} misalignment about X_{sm})
R2 = .XXXXX (Fractional number part of Y_{sm} misalignment about X_{sm})

6.3.14.37 On K-148 enter:

VERB 36 ENTR
Press ERROR RESET
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.14.38 Results. The PIPA bias determined previously in the IMU Performance Test (6.3.9) must be subtracted from the resultant data of the test.

6.3.14.38.1 Y PIPA misalignment

R1 R2

About Z axis (from 6.3.14.31) = ±XXXXX. XXXXX $\widehat{\text{sec}}$

Less Y PIPA bias (from 6.3.9) = -(±XXXXX. XXXXX) $\widehat{\text{sec}}$

Y PIPA misalignment about Z axis = ------ . ------ $\widehat{\text{sec}}$

This value shall not exceed $\pm\underline{255}$ $\widehat{\text{sec}}$

6.3.14.38.2 Z PIPA misalignment

R1 R2

About Y axis (from 6.3.14.32) = ±XXXXX. XXXXX $\widehat{\text{sec}}$

Less Z PIPA bias (from 6.3.9) = - (±XXXXX. XXXXX) $\widehat{\text{sec}}$

Z PIPA misalignment about Y axis = ± ------ . ------ $\widehat{\text{sec}}$

This value shall not exceed $\pm\underline{255}$ $\widehat{\text{sec}}$

6.3.14.38.3 Z PIPA misalignment

R1 R2

About Y axis (from 6.3.14.35) = ±XXXXX. XXXXX $\widehat{\text{sec}}$

Less X PIPA bias from (6.3.9) = -(±XXXXX. XXXXX) $\widehat{\text{sec}}$

X PIPA misalignment about Y axis = ± ------ . ------ $\widehat{\text{sec}}$

This value shall not exceed $\pm\underline{255}$ $\widehat{\text{sec}}$

6.3.14.38.4 Y PIPA misalignment

R1 R2

About X axis from (6.3.14.36) = ±XXXXX. XXXXX $\widehat{\text{sec}}$

Less Y PIPA bias (from 6.3.9) = -(±XXXXX. XXXXX) $\widehat{\text{sec}}$

Y PIPA misalignment about X axis = ± ------ . ------ $\widehat{\text{sec}}$

This value shall not excee $\pm\underline{255}$ $\widehat{\text{sec}}$

6.3.15 AOT Functional Accuracy Test

NOTE: Use of a Dioptometer is required when sighting through AOT.

6.3.15.1 Determination of Detent Angle Reference.

NOTE: The included angles between targets LOS shall be known to ±10 arc seconds. The elevation of each target LOS shall be known to ±15 arc seconds.

6.3.15.1.1 Place AOT in L detent position.

NOTE: Communication between AOT and target theodolite operators is required.

6.3.15.1.2 While viewing through AOT, instruct the target L operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target L, until the target reticle appears in the lower right quadrant of the AOT field of view.

NOTE: The target theodolite base must be level when alignment is achieved.

6.3.15.1.3 Upon alignment, zero the azimuth dial and record the elevation indication of target L as ϕ_1.

6.3.15.1.4 Place AOT in R detent position.

6.3.15.1.5 While viewing through AOT, instruct the target R operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target R, until the target reticle appears in the lower left quadrant of the AOT field of view.

6.3.15.1.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record the target R elevation dial indication as ϕ_3. Zero the target R azimuth dial. Record AOT dial indication as RY = XXX.XX.

6.3.15.1.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT dial indication as RS = XXX.XX.

6.3.15.1.8 Collimate L and R targets on each other, record each target azimuth with each target LOS leveled.

Target L az = α_1, Target R az = α_3

6.3.15.1.9 Place the AOT in F detent position.

6.3.15.1.10 Move the R target theodolite to a position in front of the AOT F detent position. (The target shall now be referred to as the F target).

6.3.15.1.11 While viewing through the AOT, instruct the target F operator to translate (vertically and laterally) and rotate(in azimuth and elevation) target F until the center of the target reticle appears in the center of the AOT reticle.

6.3.15.1.12 Upon alignment, zero the azimuth dial and record the elevation indication of target F as ϕ_2.

6.3.15.1.13 Collimate L and F targets on each other, record each target azimuth with each target LOS leveled. Target F az = α_2.

6.3.15.1.14 Determine the true azimuth of targets L and F with respect to the AOT. The target azimuth shall be known to within 0.5 arc degrees.

6.3.15.1.15 Rotate the F target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.12.

6.3.15.1.16 Rotate the L target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.13.

6.3.15.1.17 Calculate the values of the included angles between target L and F as X_1 and targets L and R as X_2.

$$X_1 = \cos^{-1}\left\{\sin\phi_1 \sin\phi_2 + \cos\phi_1 \cos\phi_2 \cos\left[180-(\alpha_1+\alpha_2)\right]\right\}$$
$$X_2 = \cos^{-1}\left\{\sin\phi_1 \sin\phi_3 + \cos\phi_1 \cos\phi_3 \cos\left[180-(\alpha_3+\alpha_1)\right]\right\}$$

Where: α_1 = az value, step 6.3.15.1.8
α_2 = az value, step 6.3.15.1.13
α_3 = az value, step 6.3.15.1.8

6.3.15.2 Computer Loading of Detent Calibration Data

6.3.15.2.1 On K-148 enter:

VERB 21	NOUN 03	ENTR
01462		ENTR
XXX.XX		ENTR (Detent L az data)
		ENTR
01463		ENTR
XXX.XX		ENTR (Detent F az data)
		ENTR
01464		ENTR
XXX.XX		ENTR (Detent R az data)
		ENTR
01465		ENTR
XXX.XX		ENTR (Detent L EL data)
		ENTR
01466		ENTR
XXX.XX		ENTR (Detent F EL data)
		ENTR
01467		ENTR
XXX.XX		ENTR (Detent R EL data)
		ENTR

6.3.15.3 AOT Measurement of [illegible]

6.3.15.3.1 On K-148 enter:

VERB 57	ENTR
00012	ENTR

Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display.

6.3.15.3.2 On Computer Control and Reticle Dimming Assembly press MARK X pushbutton. Observe VERB 50 displayed on CRT DSKY display.

6.3.15.3.3 On DSKY press ENTR
Observe VERB 21 NOUN 30 flashing on DSKY

6.3.15.3.4 On DSKY enter:

00000 ENTR
Observe VERB 21 NOUN 43 flashing
00001 ENTR
Observe VERB 21 NOUN 42 flashing

6.3.15.3.5 Set AOT in L detent position.

6.3.15.3.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record as LY = XXX.XX.

6.3.15.3.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT dial indication as LS XXX.XX.

6.3.15.3.8 On DSKY enter:

±XXX.XX ENTR (LY from 6.3.15.3.6)
Observe VERB 22 NOUN 42 flashing
±XXX.XX ENTR (LS from 6.3.15.3.7)
Observe VERB 51 flashing and R1 = 00002.

6.3.15.3.9 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed.

6.3.15.3.10 On DSKY press ENTR
Observe VERB 21, NOUN 30 flashing on DSKY.

6.3.15.3.11 On DSKY enter:

00000 ENTR
Observe VERB 21, NOUN 43 flashing
00002 ENTR
Observe VERB 21, NOUN 42 flashing

6.3.15.3.12 Set AOT in F detent position.

6.3.15.3.13 Rotate AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Record AOT dial indication as FY = XXX.XX.

6.3.15.3.14 Rotate the AOT control knob until the center of the target reticle is superimposed between the double S reticle lines. Record AOT dial indication as FS = XXX.XX.

6.3.15.3.15 On DSKY enter:

±XXX.XX ENTR (FY from 6.3.15.3.13)
Observe VERB 22 NOUN 42 flashing
±XXX.XX ENTR (FS from 6.3.15.3.14)
Observe VERB 06 NOUN 03, R1 = X1±0.06 degrees.

6.3.15.4 AOT Measurement of X2

6.3.15.4.1 On K-148 enter

VERB 57 ENTR
00012 ENTR
Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display

6.3.15.4.2 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed on CRT DSKY display.

6.3.15.4.3 On DSKY press ENTR. Observe VERB 21 NOUN 30 flashing on DSKY.

6.3.15.4.4 On DSKY enter:

00000 ENTR
Observe VERB 21 NOUN 43 flashing
00001 ENTR
Observe VERB 21 NOUN 42 flashing
±XXX.XX ENTR (LY from 6.3.15.3.6)
Observe VERB 22 NOUN 42 flashing
±XXX.XX ENTR (LS from 6.3.15.3.7)
Observe VERB 51 flashing and R1 = 00002.

6.3.15.4.5 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed.

6.3.15.4.6 On DSKY press ENTR. Observe VERB 21, NOUN 30 flashing on DSKY.

6.3.15.4.7 On DSKY enter:

00000 ENTR
Observe VERB 21 NOUN 43 flashing
00002 ENTR
Observe VERB 21 NOUN 42 flashing
±XXX.XX ENTR (RY from 6.3.15.1.6)
Observe VERB 22 NOUN 42 flashing
±XXX.XX ENTR (RS from 6.3.15.1.7)
Observe VERB 06 NOUN 03, R1 = X2±0.08 degrees.

APPENDIX I

MEASUREMENT TOLERANCES

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY 1% OF FULL SCALE
GG 1020 link 4*	+14 vdc LGC Supply	14.0±0.2 vdc	0%
GG 1030 link 4	+4 vdc LGC Supply	4.0±0.15 vdc	0%
GG 1040 link 5**	+120 vdc PIPA Supply	120±6.0 vdc	1%
GG 1070 link 4	+4 vdc CDU Supply	4.0±0.2 vdc	0%
GG 1100 link 4	-28 vdc Supply	-27.5±6.0 vdc	0%
GG 1110 link 5	2.5 vdc Telemetry Bias No. 1	2.5±0.1 vdc	0%
GG 1201 link 5	IMU 28V 800 cps 1%	28±0.56V rms	1%
GG 1202 link 4	IMU 28V 800 cps 5%	28±1.4V rms	1.5%
GG 1203 link 4	IMU 28V 800 cps 5%	28±2.1V rms	1.5%
GG 1331 link 5	3.2 kc 28V Supply 1%	28.6±0.56V rms	1%
GG 1500 link 4	+28 vdc IMU Oper BUS	28.0 -3.5, +5.5 vdc	0%
GG 1510 link 4	+28 vdc IMU STBY BUS	28.0 -3.5, +5.5 vdc	0%
GG 1513X link 5	+28 vdc IMU STBY/OFF	28.0±1 vdc	0%
GG 1520 link 4	+28 vdc LGC Oper BUS	28.0 +4.5, -3.5 vdc	0%
GG 1523X link 5	+28 vdc LGC Operate	28.0±1 vdc	0%
GG 2001 link 5	X PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2021 link 5	Y PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2041 link 5	Z PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2106 link 4	IG Servo Error Total	0.0±60 MV rms at null	1%
GG 2107 link 5	IG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2110 link 4	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2110 link 5	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2112 link 5	IG 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 2113 link 5	IG 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 2121 link 5	IG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2136 link 4	MG Servo Error Total	0.0±60 MV rms at null	1%
GG 2137 link 5	MG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2140 link 5	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2140 link 5	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2142 link 5	MG 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 2143 link 5	MG 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 2151 link 5	MG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2166 link 4	OG Servo Error Total	0.0±60 MV rms at null	1%
GG 2167 link 5	OG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2170 link 4	OG Torque Motor Current	0.9 AMP Max during any fine Align Torque	0%
NG 1336 link 4	PH DIFF 3.2kc 28V/LGC SYNC	0° ±10°	3%

APPENDIX I (Continued)

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY ±% OF FULL SCALE
GG 2170 link 5	OG Torque Motor Current	0.9 AMP Max during any fine Align Torque	1%
GG 2172 link 5	OG 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 2173 link 5	OG 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 2181 link 5	OG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2219 link 5	Pitch Attitude Error	5.05±0.5V rms at 17°	1%
GG 2220 link 4	IG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2221 link 4	IG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2249 link 5	YAW Attitude Error	5.05±0.5V rms at 17°	1%
GG 2250 link 4	MG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2251 link 4	MG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2279 link 5	Roll Attitude Error	5.05±0.5V rms at 17°	1%
GG 2280 link 4	OG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2281 link 4	OG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2300 link 5	PIPA Temperature	130.5±1.5°F in Operate	1%
GG 2301 link 4	IRIG Temperature	135±2.5°F in Operate	1%
GG 2301 link 5	IRIG Temperature	135±2.5°F in Operate	1%
GG 2302 link 4	IMU Heater Current On	28±1 vdc	0%
GG 2303 link 4	IMU Blower Current On	28±1 vdc	0%
GG 3304 link 5	RR Shaft 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3305 link 5	RR Shaft 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 3311 link 4	RR Shaft CDU Fine Error	0.0±0.07V rms at null	1%
GG 3312 link 4	RR Shaft CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3321 link 4	RR Trunnion CDU Fine Error	0.0±0.07V rms at null	1%
GG 3322 link 4	RR Trunnion CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3324 link 5	RR Trunnion 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3325 link 5	RR Trunnion 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 4300 link 4	LGC Temperature	87.5±42.5°F	0%
GG 6020 link 4	PIPA Calibration Module Temperature	67.5±22.5°F	0%
GG 6020 link 5	PIPA Calibration Module Temperature	67.5±22.5°F	0%
GG 6021 link 4	PSA Temperature	85±25.0°F	0%

* Link 4 - PSAAM Output Signal
** Link 5 - SCA Output Signal

ADDENDUM 1

LEM 1

ADDITION 1: The following procedure will be performed for LEM 1 only.

6.3.16 Gyrocompassing Test

6.3.16.1 Insure that the IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.16.2 On K-148 enter the following sequence:

VERB 57 ENTR
00006 ENTR

6.3.16.3 VERB 06 NOUN 61 shall flash.

6.3.16.4 The CRT, DSKY display shall display Launch Azimuth. (Launch Azimuth shall be the GAEC Navigator Base Azimuth defined by GAEC).

6.3.16.5 If value for Row 1 is correct, proceed to the next step. If value for Row 1 is incorrect, enter the following into K-148:

VERB 21 ENTR
±XXXXX ENTR Correct launch azimuth (GAEC Nav Base Az)

Verify value in Row 1 is correct.

6.3.16.6 On K-148 enter the following:

VERB 33 ENTR

6.3.16.7 VERB 06 NOUN 61 shall flash.

6.3.16.8 The CRT, DSKY display shall display Navigation Base Azimuth and Latitude, respectively.

6.3.16.9 If the values for Row 1 and Row 2 are correct, proceed to the next step. If the values for Row 1 or Row 2 are incorrect, enter the following into K-148.

If Row 1 is incorrect: VERB 21 ENTR
±XXXXX ENTR (Correct Nav Base Azimuth)

If Row 2 is incorrect: VERB 22 ENTR
+40.748 ENTR (Correct Site Latitude)

Verify values for Row 1 and Row 2 are correct.

6.3.16.10 On K-148 enter the following:

VERB 33 ENTR
VERB 16 NOUN 20 ENTR

6.3.16.11 One hour after step 6.3.16.10 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.16.12 Obtain and record the latest measured value of the following data.

6.3.16.12.1 NBDX

6.3.16.12.2 NBDY

6.3.16.12.3 NBDZ

6.3.16.12.4 ADIAZ

6.3.16.12.5 ADSRAY

6.3.16.12.6 GAEC NB YZ plane about Z local vertical.

6.3.16.12.7 GAEC NB YZ plane about Y local vertical.

6.3.16.13 Calculate the vertical and east IRIG coefficient drift contribution to azimuth error (ϕ Vert).

a. Drift (vert) = NBDZ+ADIAZ = ________________ meru

b. Drift (east) = NBDX sin α +NBDY sin (α+ 90) + ADSRAY sin (α+ 90)
Where α = Launch Azimuth

c. ϕ vert = $\frac{6.45a + 772b}{3600}$ = ______________ degrees

7?

6.3.16.14 Algebraically subtract ϕ (vert) from the Row 1 DSKY display recorded in 6.3.16.11. The resultant azimuth error shall be 000.00±000.57 degrees.

6.3.16.15 Algebraically subtract the value recorded in 6.3.16.12.6 from the Row 3 DSKY display recorded in 6.3.16.11. The resultant vertical error about Z local vertical shall be 000.00±000.06 degrees.

6.3.16.16 Algebraically subtract the value recorded in 6.3.16.12.7 from the Row 2 DSKY display recorded in 6.3.16.11. The resultant vertical error about Y local vertical shall be 000.00±000.06 degrees.

6.3.16.17 Two hours after 6.3.16.10 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.16.18 The CRT DSKY display of Row 1 shall be within 000.06 degrees of the value recorded in 6.3.16.11. The CRT DSKY display of Row 2 and Row 3 shall be within 000.03 degrees of the respective values recorded in 6.3.16.11.

6.3.16.19 On K-148 enter the following:

VERB 36		ENTR
VERB 40	NOUN 20	ENTR
+00000		ENTR
+00000		ENTR
+00000		ENTR

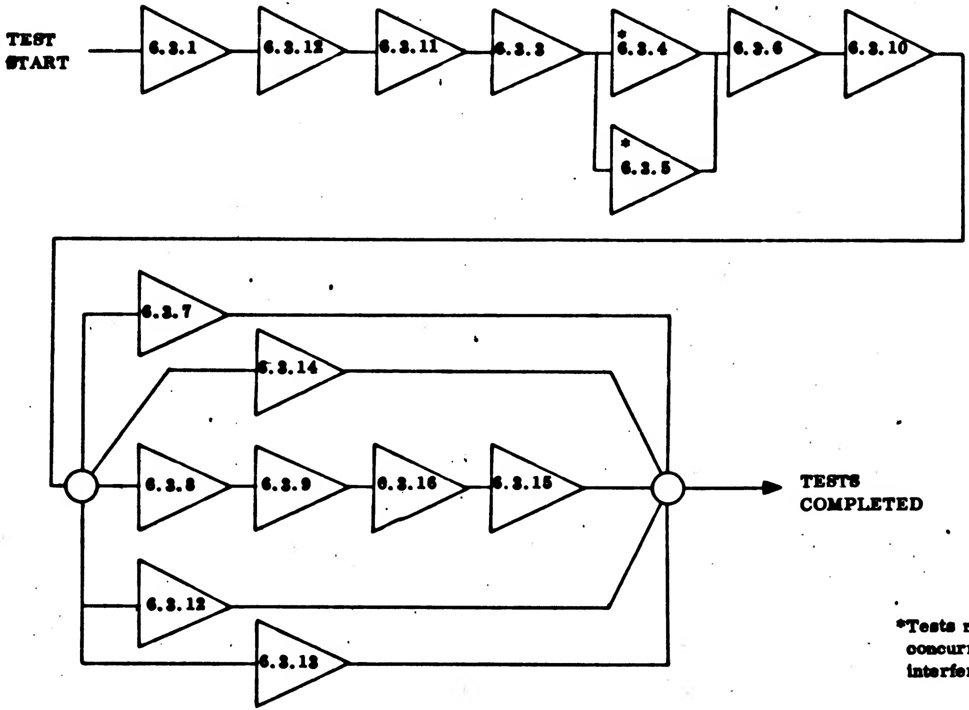
ADDENDUM 1

LEM 1

Addition 2: Perform LEM 1 test in accordance with the following Flowgram.

Addition 3: Place a note after paragraph 6.3.1.6.2.

NOTE: Before performing the following step insure that the ATCA switch on LEM Panel 16 and the ATCA/PGNCS switch on Panel 11 are in the off position.



*Tests may be performed concurrently on a non-interference basis

TEST PROCEDURE FLOWGRAM

FIGURE 1

APOLLO G&N Specification
ND 1002323 REV D

Original Issue Date:
Release Authority: TDRR 31026
Class A Release

POST-INSTALLATION CHECKOUT SPECIFICATION
FOR LEM GUIDANCE AND NAVIGATION SYSTEM

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	APPROVALS	
				AC	NASA
Ⓜ 11/23/66	A	32056	1-83 Was 83 pages, now 80 pages.	EA	WLS
Ⓜ 12/29/66	B	32480	6-46, 51, 62, 67, 73, 74, 78 R06/ac	JP	- -
Ⓜ 2/27/67	C	33084	5-86 R04/ac	EA	—
4/17/67	D	33613	3, 6, 7, 16, 17, 18, 22, 23, 28, 35,		
			44, 45, 64, 79, 85 R06/ac	EA	WLS

This specification consists of page 1 to 86 inclusive.

APPROVALS	NASA/MSC				ACED 9/13/66

3. APPLICABLE DOCUMENTS

3.1

Document Number	Subject
LIS-540-10001	LEM-PGNS Functional Interface
LID-340-10000	ICD-PGNS (LGC-CDU-PSA and Sig. Cond.) Instl.
LID-340-10010	ICD-LEM DSKY Installation
LID-280-10004	ICD-IMU-AOT-NVB-PTA Installation
LID-390-10001	ICD-LEM Wiring Electrical Interface for PGNS
LID-540-10001	ICD-LEM-PGNS Functional Interface Flow Diagram
LIS-510-10001	Thermodynamic Requirements of Guidance & Navigation Equipment - GAEC
LIS-520-10001	LEM Design Environment
LIS-350-10002	LEM-PGNS Lateral and Forward Velocity Interface
LIS-370-10007	LEM PGNS 800 CPS Power Electrical Interface
LIS-370-10003	LEM-PGNS Measurement Interface
LIS-370-10004	LEM-LGC Electrical Interface
LIS-390-10002	Guidance and Navigation Prime Power Requirements and Characteristics
LID-410-10002	ICTC System Interface
LID-410-10003	PSA Adapter Module Interface
PS-6015000	Master End Item Specification Product Configuration and Acceptance Test Requirement PGNCS Spacecraft Equipment

3.2 The following addendums are applicable to this document:

3.2.1 Addendum I LEM 1

5.2.2 The PSA, CDU, and PTA cold plates shall be provided with coolant as per ICD LIS-510-10001.

5.3 TEST EQUIPMENT TOLERANCES

5.3.1 Measurement and tolerance specifications stated herein are basic G&N system performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. Final tolerances must include PSAAM and SCA stability. uncertainties. All uncertainties due to instrumentation shall be root sum squared with the basic G&N tolerances to yield an acceptable tolerance for use when testing the G&N system in the spacecraft.

5.3.2 In the event of a conflict between requirements, the following order of precedence shall apply. The contractor shall also notify AC Electronics Site Manager of the conflict.

a. The contract
b. This specification
c. Documents referenced in this specification

5.4 TEST SEQUENCE

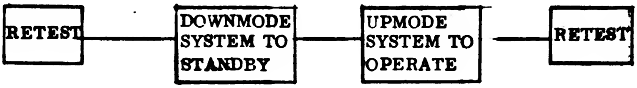
5.4.1 The test sequence shall normally follow the flow gram in Figure 1. Any test subsequent to Temperature Control Verification Section 6.3.4 may be conducted providing the General Turn On Procedure 6.2.4 is followed.

5.5 The generation of a noise alarm indication, as evidenced by one or more Noise Peak Event lamps becoming lighted shall be cause for immediate determination of effects on the G&N system test in progress. In the event of detrimental effects on the system test a troubleshooting routine shall be entered to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.

5.6 TEST FAILURE CRITERIA

5.6.1 IRIG and PIPA data (See paragraph 6.3.9)

5.6.1.1 If D_1, D_2, or D_3 exceeds its maximum value for any PIPA or IRIG, that PIPA or IRIG shall be retested in the following sequence.



If D_1, D_2, and D_3 are within tolerance after the retest sequence is completed, the original out-of-tolerance terms calculated in paragraph 6.3.9.70.4 shall be exonerated.

5.6.1.2 Failure to be within the maximum values of D_1, D_2, and D_3 after the retest sequence of 5.6.1.1 shall constitute a failure of the assembly.

5.6.2 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N System as non-conforming. Normal test sequence may be continued upon determination of the cause of the nonconformance or at the discretion of the G&N contractor test team if it is determined that such action is not detrimental to the G&N System or other interfacing subsystems. All nonconformances shall be investigated and cleared by waivers (F.N.N.), correction of specification, or hardware replacement and retest. The suspected malfunctioned hardware shall be removed and returned to the laboratory where the malfunction shall be verified. Only after malfunction verification shall a flight certified replaceable element be installed in the G&N System.

5.7 Retest subsequent to replacement of a malfunctioned assembly with that of a flight certified assembly shall be at the discretion of NASA Engineering. Table II can be used as a guide to determine general retest requirements. In all retest procedures, the test sequence of Figure 2 shall be adhered to.

5.8 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps pertaining directly to the G&N components. If any questions arise concerning the test equipment, the Test Conductor should refer to the respective operational manuals.

5.9 Spacecraft systems other than the G&N System may be operating on a noninterfering basis while individual system checkout of the G&N is being conducted.

5.10 DATA RETRIEVAL

5.10.1 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance reading shall be recorded and flagged by appropriate signals.

6.3.1.3 The following switches and/or circuit breakers shall be closed to energize the indicated buses.

LOCATION	NOMENCLATURE	IDENTIFICATION
Panel 14	BAT 5 NORMAL FEED	4S10
Panel 14	BAT 6 NORMAL FEED	4S11
Panel 16	X LUNAR BUS TIE	4CB5
Panel 16	BAT 1-4-6 FEED TIE	4CB17
Panel 16	BAT 2-3-5 FEED TIE	4CB25
Panel 16	ASC ECA	4CB14
Panel 16	ASC ECA CONT.	5CB7
Panel 16	DC BUS VOLT	4CB21
Panel 16	DISP.	4CB16
Panel 11	X LUNAR BUS TIE	4CB4
Panel 11	BAT 1-4-6 FEED TIE	4CB18
Panel 11	BAT 2-3-5 FEED TIE	4CB26
Panel 11	ASC ECA	4CB15
Panel 11	ASC ECA CONT.	4CB6
Panel 11	DC BUS VOLT	4CB22
Panel 16	INV. NO. 2	4CB13
Panel 14	AC PWR to INV 2 Position	4S14
Panel 11	AC BUS FEED TIE	4CB24
Panel 11	AC BUS VOLT	4CB27

6.3.1.4 IMU Standby Power Turn On

6.3.1.4.1 Turn on Event Recorder at a speed of .1 mm/sec. (10/100 mm/sec.).

6.3.1.4.2 Press in +28VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11. Record time.

6.3.1.4.3 Verify on event recorder that +28 VDC IMU STANDBY power discrete (GG 1513) is on. On CRT, +28V IMU STANDBY Bus (GG 1510) shall indicate between 24.5 and 33.5.

6.3.1.4.4 On CRT, the 28V 3200 CPS SUPPLY (GG 1331) shall indicate between 28.04 and 29.16 VRMS. Record this value.

6.3.1.4.5 The PIPA TEMP displayed on CRT, shall be monitored periodically for one hour to ensure that the PIPA Temperature Control circuitry is operating to maintain a temperature of 130±5.0 DEG F. (GG 2300). One hour after performing step 6.3.1.4.2 record PIPA TEMP.

6.3.1.5 Computer Power Turn On

6.3.1.5.1 Press in +28VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11.

6.3.1.5.2 Depress STBY pushbutton on DSKY for three seconds and verify STBY light on DSKY is OFF.

6.3.1.5.3 On CRT, +28V LGC Operate Bus (GG1520) shall indicate between 24.5 and 33.5. Ignore computer alarm indications. Verify on event recorder that +28V LGC OPERATE (GG 1523X) discrete is ON. Using DSKY, enter VERB 36 ENTR then press RSET. All Computer alarms shall clear.

6.3.1.5.4 On CRT, the +14VDC LGC SUPPLY (GG 1020) shall indicate between 13.6 and 14.4 VDC. Record this value.

6.3.1.5.5 On CRT, the +4 VDC LGC SUPPLY (GG 1030) shall indicate between 3.8 and 4.2 VDC. Record this value.

6.3.1.6 LGC Operational Tests

6.3.1.6.1 DSKY Check

6.3.1.6.1.1 Initiate the DSKY check by entering in the DSKY:

Press ERROR RESET
VERB 37 ENTR 00015 ENTR (clear erasable memory)
VERB 21 NOUN 27 ENTR
00011 ENTR

6.3.1.6.1.2 All the electroluminescent elements (PROG, VERB, NOUN, and Row 1, Row 2, Row 3) shall display the decimal number (9). Including the 9's, each of the following shall be displayed for approximately 5 seconds.

a. 9's
b. 8's
c. 7's
d. 6's
e. 5's
f. 4's
g. 3's
h. 2's
i. 1's
j. 0's
k. Minus signs in Row 1, ROW 2, ROW 3
l. VERB-NOUN Flashing
m. COMP ACTY

(k–m) On concurrently for 5 seconds

o. Plus signs in ROWS 1, 2, and 3
p. VERB-NOUN Flashing
q. COMP ACTY
} On concurrently for 5 seconds
r. COMP ACTY - On for 5 seconds then DSKY blanks.

6.3.1.6.1.3 The DSKY pushbuttons shall be checked by entering:

VERB 25 NOUN 01 ENTR
01740 ENTR
+00123 ENTR
-00456 ENTR
-00789 DO NOT press ENTR
The DSKY shall display +00123 in Row 1, -00456 in Row 2, and -00789 in Row 3. Press CLR pushbutton three times on DSKY. Observe that Row 1, Row 2, and Row 3 are blank.

6.3.1.6.2 Lamp Test

6.3.1.6.2.1 Initiate the Lamp Test by entering in the DSKY:

VERB 35 ENTR

6.3.1.6.2.2 The following DSKY displays shall illuminate for approximately 5 seconds..

a. UP LINK ACTY
b. NO ATT
c. STBY
d. KEY REL
e. TEMP
f. GIMBAL LOCK
g. PROG
h. RESTART
i. TRACKER
j. OPR ERROR Flashing
k. VERB-NOUN Flashing
l. Plus 88888 in Row 1, Row 2, and Row 3
} On concurrently for approximately 5 seconds.

6.3.1.6.3 Uplink Check

6.3.1.6.3.1 On K-START 148; set LOAD/INHIBIT switch to LOAD, set TAPE/KEY switch to KEY, then enter the following:

ERROR RESET
VERB 25 NOUN 01 ENTR
02400 ENTR
+01234 ENTR
-56789 ENTR
+00000 ENTR

6.3.3 IMU OPERATE POWER ON TESTS

NOTE: Perform the following DSKY entries before continuing:

a.	VERB 25 NOUN 01	ENTR
b.	03770	ENTR SET LOC
c.	10067	ENTR CCS NEW JOB
d.	04317	ENTR TC CHANG 1
e.	01770	ENTR TC ACTLITON
f.	VERB 25 NOUN 26	ENTR CALL PRIO/DELAY
g.	01000	ENTR 01 PRIORITY
h.	01770	ENTR RELATIVE E-MEM
i.	00007	ENTR BANK ADD
j.	VERB 30	ENTR REQ EXEC.

CAUTION

Prior to application of IMU OPERATE power in step 6.3.3.1.4, LGC OPERATE and IMU STANDBY power must have been applied to the G&N System continuously for a minimum of two hours. The only exception is when the requirements of step 6.2.4.10 are met and this does not apply for the initial application of IMU OPERATE power.

6.3.3.1 Verification of Power Turn-On

6.3.3.1.1 Set up analog recorder to monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps
h.	SPARE	

6.3.3.1.2 Start analog recorder to a chart speed of 5 mm/sec. Start event recorder at a chart speed of 1 mm/sec.

6.3.3.1.3 On CRT, monitor +120 VDC PIPA SUPPLY (GG1040) and IMU gimbal angles.

6.3.3.1.4 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.3.3.1.5 Verify on analog recorder that the oscillations of the resolver sine signals (GG2112, GG2172, and GG2142) are not sustained and that the signals damp out within 15 seconds. If they don't, remove IMU OPERATE power as soon as possible.

6.3.3.1.6 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.3.3.1.4 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.3.3.1.4.

6.3.3.1.7 On event recorder verify the following:

LGC WARNING is OFF (GG9001)
ISS WARNING is OFF (GG9002)
PGNCS CAUTION is OFF (GG9003)

6.3.3.1.8 On CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.3.1.9 On K-148 enter the following sequence:

```
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR
```

6.3.4 Temperature Control Verification

6.3.4.1 When 15 minutes have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP (GG2300). The measured temperature shall be within 0.5° of PIPA TEMP measured in 6.3.1.4.5.

6.3.4.2 When 30 minutes have elapsed from the time of IMU OPERATE power turn-on record IRIG TEMP (GG2301).

6.3.4.3 When 1 hour has elapsed from the time of IMU OPERATE power turn-on, monitor PIPA TEMP (GG2300) and IRIG TEMP (GG2301) on the CRT. Monitor and record temperature readings every 5 minutes for 30 minutes. Verify that each reading does not deviate from the average value of each signal by more than 0.1°F.

6.3.4.4 The PIPA temp shall be 130.5 (±1.5°)F. The IRIG TEMP shall be 135 (±2.5°)F and within 3.0°F of the PIPA TEMP. The PIPA Temp shall be 130.5 (±[illegible])°F. The I.R.I.G TEMP shall be [illegible] (±[illegible])F.

6.3.4.5 The PIPA TEMP recorded in step 6.3.4.4 shall be within 1.0°F of the temperature recorded in step 6.3.1.4.5 and within 0.5° of the temperature recorded in 6.3.4.1.

6.3.4.6 The IRIG TEMP recorded in step 6.3.4.4 shall be within 0.5°F of the temperature recorded in step 6.3.4.2.

6.3.5 PGNCS Power Supply Tests

6.3.5.1 From the CRT, confirm power supply voltages (or temperatures) are as specified and record values observed.

6.3.5.2 The PIPA Calibration Module Temperature (GG6020) shall be between +45 and +90 DEG F.

6.3.5.3 The PSA Temperature (GG6021) shall be between +60 and +110 DEG F.

6.3.5.4 The LGC Temperature (GG4300) shall be between +45 and +130 DEG. F.

6.3.5.5 The +28 VDC IMU OPERATE BUS (GG1500) shall be between 24.5 and 33.5 VDC.

6.3.7.12.2 Read and record the CRT DSKY Row 1, 2, and 3 indications. The indication shall be between 00012 and 00016.

6.3.7.12.3 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.12.4 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on the DSKY shall not be lighted.

6.3.7.13 Command Accuracy 315° .

6.3.7.13.1 On K-148 insert VERB 33 ENTR. In approximately 20 seconds VERB 33 NOUN 20 will be displayed flashing.

6.3.7.13.2 Read and record CRT indication of IMU gimbal angles. The indications shall be 315±001 degrees.

6.3.7.13.3 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indications shall be +315±00007.

6.3.6.14 CDU Repeating Accuracy 315°

6.3.7.14.1 On K-148 press ENTR. In approximately 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.14.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.15 -Gimbal Lock Test

6.3.7.15.1 On K-148 Press VERB 33 ENTR. In approximately 20 seconds VERB 33, NOUN 22 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.15.2 On K-148 Press ENTR. In approximately 20 seconds VERB 33 NOUN 23 will be displayed flashing.

6.3.7.15.3 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indications shall be

Row 1	22500±00007
Row 2	22500±00007
Row 3	00000±00007

6.3.7.16 CDU Repeating Accuracy 225°

6.3.7.16.1 On K-148, press ENTR. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.16.2 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indication shall be between 77774 and 00003.

6.3.7.17 On K-148 Press VERB 33 ENTR. The GIMBAL LOCK lamp shall not be lighted. VERB 21, NOUN 22 is displayed flashing.

6.3.9.6 Perform the following calculations:

a. $\frac{\text{BBBBB} \times 5.12}{3600}$ = CCCC.C (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours.

c. DDDD.D + present time of day = time of day at which high order scalar register will overflow.

6.3.9.7 If the time of day is within 12 minutes of that calculated in 6.3.9.6.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.9.6.c has passed and proceed.

Paragraph

6.3.9.15
6.3.9.22
6.3.9.30
6.3.9.36
6.3.9.43
6.3.9.48

6.3.9.8 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTR
00370 ENTR
Record contents of CRT DSKY Row 1 XXXXY
VERB 21 NOUN 01 ENTR
00370 ENTR
XXXXY' ENTR
Where Y' is obtained from Table 1a.
VERB 57 ENTR
00001 ENTR
VERB 06 NOUN 61 shall flash

6.3.9.9 On the CRT, DSKY display verify R1 (Navigation Base Azimuth) and R2 (Site Latitude) are correct.

6.3.9.10 If values for R1 and R2 are correct, proceed to next step.
If values for R1 and R2 are incorrect, enter the following sequence into K-148.

VERB 24 ENTR
±xxx.xx ENTR (Correct navigation base azimuth ±0.50 deg)
+40.748 ENTR (Correct site latitude)
Verify values in R1 and R2 are correct.

6.3.9.11 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

DATA SHEET

CALCULATION	PARAMETER	UNITS	
line c - line f = ( ) ---.-- (-NBDX+ADIAX) - (-NBDX) Transfer result to line al.	ADIAX	meru	q
line h - line a = ( ) ---.-- (+NBDY+ADSRAY) - (+NBDY) Transfer result to ai.	ADSRAY	meru	r
line j - line c = ( )---.--- (+NBDZ+ADIAZ) - (NBDZ) Transfer result to line am.	ADIAZ	meru	s
(line m - line f)X1.414 = ( ) ---.-- [(-NBDX + .707 ADSRAX) - (-NBDX)] X 1.414 Transfer result to line ak.	ADSRAX	meru	t
(line o + line c) X1.414 = ( ) ---.-- (-NBDZ + .707 ADSRAZ + NBDZ) X1.414 Transfer result to line ai.	ADSRAZ	meru	u
(line p - .707 line a - .707 line f +.5 line q -.5 line t) X2 = ---.-- [.707 (NBDY-NBDX) +.5 (ADIAY-ADIAX) +.5 ADSRAX -.707 (-NBDX) -.707 NBDY +.5 ADIAX-.5 ADSRAX] X2 Transfer result to line an.	ADIAY	meru	v
line b - line d = ( )	PIPA X2G	cm/sec^2	w
line k - line l = ( )	PIPA Y2G	cm/sec^2	x
line g - line i = ( )	PIPA Z2G	cm/sec^2	y
1960.52 ÷ line w x 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line ao.	X PIPA S. F.	cm/sec/ pulse	z
1960.52 ÷ line x X 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line ap.	Y PIPA S. F.	cm/sec/ pulse	aa
1960.52 ÷ line y X 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line aq.	Z PIPA S. F.	cm/sec/ pulse	ab
1/2 (line b + line d) = ( ) --.-- Transfer results to line ar	X PIPA Bias	cm/sec^2	ac
1/2 (line k + line l) = ( ) --.--- Transfer results to line as	Y PIPA Bias	cm/sec^2	ad
1/2 (line g + line i) = ( ) --.--- Transfer results to line at	Z PIPA Bias	cm/sec^2	ae

TABLE I

Y	Y'
0	2
1	3
2	2
3	3
4	6
5	7
6	6
7	7

DATA SHEET
(x_i)

PARAMETER	UNITS	MIN VALUE	RECORDED VALUE	MAX VALUE	REJ	ACC	
NBDY	meru	-15		+15			af
NBDZ	meru	-15		+15			ag
NBDX	meru	-15		+15			ah
ADSRAY	meru	-40		+40			ai
ADSRAZ	meru	-40		+40			aj
ADSRAX	meru	-40		+40			ah
ADIAX	meru	-100		+100			al
ADIAZ	meru	-100		+100			am
ADIAY	meru	-100		+100			an
X PIPA S.F. error from line z	PPM	-1900		+1900			ao
Y PIPA S.F. error from line aa	PPM	-1900		+1900			ap
Z PIPA S.F. error from line ab	PPM	-1900		+1900			aq
X PIPA Bias from line ac	cm/sec^2	-3.1		+3.1			ar
Y PIPA Bias from line ad	cm/sec^2	-3.1		+3.1			as
Z PIPA Bias from line ae	cm/sec^2	-3.1		+3.1			at

6.3.12.4 Test Analysis

6.3.12.4.1 Remove the strip charts from analog recorders

6.3.12.4.2 Examine each trace carefully to detect any sharp discontinuities of the traces. Disregard all transients less than 0.5 second (5 mm) on any Torque Motor Current signal. Disregard all transients less than 0.2 second (2 mm) on any CDU Fine Error signal.

6.3.12.4.3 No Torque Motor Current signal on (GG2140, GG2170, GG2110) shall ever exceed (0.125) amp. Sensitivity on recorder is 20 ma/division for GG2110, GG2140 and 36 ma/division for GG2170.

6.3.12.4.4 No CDU Fine Error on (GG2220, GG2280, GG2250) shall ever exceed (.070) volts. Sensitivity on recorder is 80 mv/division.

6.3.13 Stabilization Loop Step Response Test

6.3.13.1 IG Response Test

6.3.13.1.1 On K-148 enter the following sequence:

```
VERB 40     NOUN 20   ENTR    Wait 3 seconds
VERB 41     NOUN 20   ENTR
+00000      ENTR
+00000      ENTR
+00000      ENTR
```

6.3.13.1.2 On CRT, verify IG MG, and OG gimbal angles are between 358 and 002.

6.3.13.1.3 Set up analog recorder to monitor the following:

MEAS NO.	SIGNAL NAME
a. GG2110	IG Torque Motor Current
b. GG2106	IG Servo Error Total
c. GG2107	IG Servo Error In Phase
d. GG2112	IG 1X resolver Sine
e. GG2113	IG 1X Resolver Cosine
f. GG2220	IG CDU Fine Error
g. GG1201	IMU 28V 1 PCT 800 CPS

6.3.13.1.4 On K-148 initiate FINE ALIGN by entering the following sequence:

```
VERB 42     ENTR
+00000      ENTR
+00000      ENTR
+00000      ENTR
```

APPENDIX I

MEASUREMENT TOLERANCES

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY 1% OF FULL SCALE
GG 1020 link 4*	+14 vdc LGC Supply	14.0±0.4 vdc	0%
GG 1030 link 4	+4 vdc LGC Supply	4.0±0.2 vdc	0%
GG 1040 link 5**	+120 vdc PIPA Supply	120±6.0 vdc	1%
GG 1070 link 4	+4 vdc CDU Supply	4.0±0.2 vdc	0%
GG 1100 link 4	-28 vdc Supply	-27.5±6.0 vdc	0%
GG 1110 link 5	2.5 vdc Telemetry Bias No. 1	2.5±0.1 vdc	0%
GG 1201 link 5	IMU 28V 800 cps 1%	28±0.56V rms	1%
GG 1202 link 4	IMU 28V 800 cps 5%	28±1.4V rms	1.5%
GG 1203 link 4	IMU 28V 800 cps 5%	28±2.1V rms	1.5%
GG 1331 link 5	3.2 kc 28V Supply 1%	28.6±0.56V rms	1%
GG 1500 link 4	+28 vdc IMU Oper BUS	28.0 -3.5, +5.5 vdc	0%
GG 1510 link 4	+28 vdc IMU STBY BUS	28.0 -3.5, +5.5 vdc	0%
GG 1513X link 5	+28 vdc IMU STBY/OFF	28.0±1 vdc	0%
GG 1520 link 4	+28 vdc LGC Oper BUS	28.0 +4.5, -3.5 vdc	0%
GG 1523X link 5	+28 vdc LGC Operate	28.0±1 vdc	0%
GG 2001 link 5	X PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2021 link 5	Y PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2041 link 5	Z PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2106 link 4	IG Servo Error Total	0.0±60 MV rms at null	1%
GG 2107 link 5	IG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2110 link 4	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2110 link 5	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2112 link 5	IG 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 2113 link 5	IG 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 2121 link 5	IG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2136 link 4	MG Servo Error Total	0.0±60 MV rms at null	1%
GG 2137 link 5	MG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2140 link 4	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2140 link 5	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2142 link 5	MG 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 2143 link 5	MG 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 2151 link 5	MG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2166 link 4	OG Servo Error Total	0.0±60 MV rms at null	1%
GG 2167 link 5	OG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2170 link 4	OG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
NG 1336 link 4	PH DIFF 3.2kc 28V/LGC SYNC	0° ±10°	3%

ADDENDUM 1

LEM 1

Addition 2: Perform LEM 1 test in accordance with the following Flowgram.

Addition 3: Place a note after paragraph 6.3.1.6.2.

NOTE: If the LMP Interlock CB is energized insure that the ATCA switch on LEM Panel 16 and the ATCA/PGNCS switch on Panel 11 are in the off position before performing the following steps.

APOLLO G&N Specification
ND 1002323 REV E

Original Issue Date:
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POST-INSTALLATION CHECKOUT SPECIFICATION
FOR LM G&N SYSTEM

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	APPROVALS	
				AC	NASA
11/23/66	A	32056	1-83 Was 83 pages, now 80 pages.	EA	WLS
12/29/66	B	32480	6-46, 51, 62, 67, 73, 74, 78 RO6/AC	JP	- -
2/27/67	C	33084	5-86 RO4/AC	EA	--
4/17/67	D	33613	3, 6, 7, 16, 17, 18, 22, 23, 28, 35,		
			44, 45, 64, 79, 85 RO6/AC	EA	WLS
7/27/67	E	34218	3, 5-7, 9-12, 14, 16-86; was 86 pages	EA	--
			now 94 pages. JK/AC		

This specification consists of page 1 to 94 inclusive.

APPROVALS	NASA/MSC				ACED 9/13/66

3. APPLICABLE DOCUMENTS

3.1

Document Number	Subject
LIS-540-10001	LEM-PGNS Functional Interface
LID-340-10000	ICD-PGNS (LGC-GDU-PSA and Sig. Cond.) Instl.
LID-340-10010	ICD-LEM DSKY Installation
LID-280-10004	ICD-IMU-AOT-NVB-PTA Installation
LID-390-10001	ICD-LEM Wiring Electrical Interface for PGNS
LID-540-10001	ICD-LEM-PGNS Functional Interface Flow Diagram
LIS-510-10001	Thermodynamic Requirements of Guidance & Navigation Equipment - GAEC
LIS-520-10001	LEM Design Environment
LIS-350-10002	LEM-PGNS Lateral and Forward Velocity Interface
LIS-370-10007	LEM PGNS 800 CPS Power Electrical Interface
LIS-370-10003	LEM-PGNS Measurement Interface
LIS-370-10004	LEM-LGC Electrical Interface
LIS-390-10002	Guidance and Navigation Prime Power Requirements and Characteristics
LID-410-10002	ICTC System Interface
LID-410-10003	PSA Adapter Module Interface
PS 6015000	Master End Item Specification Product Configuration and Acceptance Test Requirement PGNCS Spacecraft Equipment

3.2 The following addendums are applicable to this document:

3.2.1 Addendum I LEM 1

3.2.2 Addendum II Aurora 85

3.2.3 Addendum III RR Interface LTA-8 (MSC) - LEM 2 & Subsequent

5. GENERAL REQUIREMENTS

5.1 SAFETY REQUIREMENTS

5.1.1 Operator Safety

5.1.1.1 Normal safety precautions shall be observed through the G&N post-installation checkout.

5.1.2 Equipment Safety

5.1.2.1 To preserve the operational life of the components of the G&N hardware under test, settings and adjustments shall be performed only when specified in the test procedure. Care shall be exercised in the accomplishment of all settings and adjustments to avoid excessive wear or damage to the equipment. All precautionary measures stated throughout the test procedures shall be strictly adhered to.

5.1.2.2 Prior to the electrical connection of the G&N System to the spacecraft harness, a complete verification of spacecraft power, including both voltage polarity as well as magnitude, shall be completed to preclude damage to the G&N due to incorrect power application.

5.1.2.3 The connection between the Portable Temperature Controller (PTC) and 56J1 shall be maintained unless otherwise specified.

5.1.2.4 The temperature of the inertial components shall be maintained between the following limits. If these limits are exceeded, the inertial components shall be recalibrated.

a. IRIG: 120 Deg F and 150 Deg F
b. PIP: 115 Deg F and 145 Deg F

5.1.2.5 All personnel concerned shall thoroughly understand the Operational Requirements in Section 6.2 to preclude any damage to the G&N System.

5.1.2.6 To preserve the operational life of the components of the DSKY, the monitor routines shall be used only when required by test procedure or trouble shooting. Such routines shall be terminated as quickly as possible in the test flow. Computer routines which cause the DSKY display to flash (either requesting data or displaying data) shall also be terminated as quickly as possible.

5.2 COOLANT REQUIREMENTS

5.2.1 When electrical power is applied to the G&N System, the IMU shall be provided with water-glycol coolant at a temperature of 32 to 60°F and a flow rate of 28-76 pounds per hour.

5.2.2 The PSA, CDU, and PTA cold plates shall be provided with coolant as per ICD LIS-510-10001.

5.3 TEST EQUIPMENT TOLERANCES

5.3.1 Measurement and tolerance specifications stated herein are basic G&N system performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. Final tolerances must include PSAAM and SCA stability uncertainties. All uncertainties due to instrumentation shall be root sum squared with the basic G&N tolerances to yield an acceptable tolerance for use when testing the G&N system in the spacecraft.

5.3.2 In the event of a conflict between requirements, the following order of precedence shall apply. The contractor shall also notify AC Electronics Site Manager of the conflict.

a. The contract
b. This specification
c. Documents referenced in this specification

5.4 TEST SEQUENCE

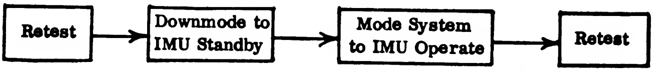
5.4.1 The test sequence shall normally follow the flowgram in Figure 1. Any test subsequent to Temperature Control Verification Section 6.3.4 may be conducted providing the General Turn On Procedure 6.2.4 is followed.

5.5 The generation of a noise alarm indication, as evidenced by one or more Noise Peak Event lamps becoming lighted shall be cause for immediate determination of effects on the G&N system test in progress. In the event of detrimental effects on the system test a troubleshooting routine shall be entered to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.

5.6 TEST FAILURE CRITERIA

5.6.1 IRIG and PIPA data (See paragraph 6.3.9)

5.6.1.1 If D_1, D_2, or D_3 exceeds its maximum value as specified in 6.3.9 for any IRIG or PIPA, a retest sequence shall be initiated as indicated below:



RETEST SEQUENCE

The retest sequence shall be performed only for the test positions indicated in the table below, corresponding to the original out-of-spec parameter. In addition, other selected parameters shall be recalculated and qualified.

O.O.S. PARAMETER	PERFORM POSITIONS	PARAMETERS TO BE REQUALIFIED
NBDY	1	NBDY
NBDZ	1 thru 2	NBDZ, NBDY, X PIPA SF error, X PIPA bias
NBDX	1 thru 3	NBDX, NBDZ, NBDY, X PIPA SF error, X PIPA bias, ADIAX
ADSRAY	1 thru 4	ADSRAY, NBDX, NBDZ, NBDY, X PIPA SF error, X PIPA bias, ADIAX, ADIAZ, Z PIPA SF error, Z PIPA bias
ADSRAZ	1 thru 9	ADSRAZ, ADSRAY, NBDX, NBDZ, NBDY, X PIPA SF error, X PIPA bias, ADIAX, ADIAZ, Z PIPA SF error, Z PIPA bias, ADSRAX, Y PIPA SF error, Y PIPA bias
ADSRAX	1 thru 7	ADSRAX, ADSRAY, NBDX, NBDZ, NBDY, X PIPA SF error, X PIPA bias, ADIAX, ADIAZ, Z PIPA SF error, Z PIPA bias, Y PIPA SF error, Y PIPA bias
ADIAY	1 thru 10	All
ADIAZ	1 thru 4	ADIAZ, NBDX, NBDZ, NBDY, X PIPA SF error, X PIPA bias, ADIAX, Z PIPA SF error, Z PIPA bias, ADSRAY
ADIAX	1 thru 3	ADIAX, NBDX, NBDZ, NBDY, X PIPA SF error, X PIPA bias
X PIPA bias or SF error	1 thru 2	X PIPA SF error, X PIPA bias, NBDZ, NBDY
Z PIPA bias or SF error	1 thru 4	Z PIPA SF error, Z PIPA bias, ADSRAY, NBDX, NBDZ, NBDY, X PIPA SF error, X PIPA bias, ADIAX, ADIAZ
Y PIPA bias or SF error	1 thru 6	Y PIPA SF error, Y PIPA bias, Z PIPA SF error, Z PIPA bias, ADSRAY, NBDX, NBDZ, NBDY, X PIPA SF error, X PIPA bias, ADIAX, ADIAZ

If D_1, D_2, and D_3 are within tolerance after the retest sequence is completed, the original out-of-tolerance terms calculated in 6.3.9.70.4 shall be exonerated.

Paragraph No.	Test Title
6.3.1	Standby Power In Test
6.3.2	Alarms and Interrupts Test
6.3.3	IMU Operate Power On Test
6.3.4	Temperature Control Verification
6.3.5	PGNCS Power Supply Test
6.3.6	IMU Operational Test
6.3.7	PGNCS Operational Test
6.3.8	IRIG Scale Factor Test
6.3.9	IMU Performance Test
6.3.10	LGC Voltage Margin Test
6.3.11	LGC Clock Frequency Test
6.3.12	Gimbal Friction Test
6.3.13	Stabilization Loop Response Test
6.3.14	G&N Fine Alignment Test
6.3.15	AOT Functional Performance Test

G&N TESTS

FIGURE 1

5.6.1.2 Failure to be within the maximum values of D_1, D_2, and D_3 after the retest sequence of 5.6.1.1 shall constitute a failure of the assembly.

5.6.2 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N System as non-conforming. Normal test sequence may be continued upon determination of the cause of the nonconformance or at the discretion of the G&N contractor test team if it is determined that such action is not detrimental to the G&N System or other interfacing subsystems. All nonconformances shall be investigated and cleared by waivers (F.N.N.), correction of specification, or hardware replacement and retest. The suspected malfunctioned hardware shall be removed and returned to the laboratory where the malfunction shall be verified. Only after malfunction verification shall a flight certified replaceable element be installed in the G&N System.

5.7 Retest subsequent to replacement of a malfunctioned assembly with that of a flight certified assembly shall be at the discretion of NASA Engineering. Table II can be used as a guide to determine general retest requirements. In all retest procedures, the test sequence of Figure 2 shall be adhered to.

5.8 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps pertaining directly to the G&N components. If any questions arise concerning the test equipment, the Test Conductor should refer to the respective operational manuals.

5.9 Spacecraft systems other than the G&N System may be operating on a noninterfering basis while individual system checkout of the G&N is being conducted.

5.10 DATA RETRIEVAL

5.10.1 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance reading shall be recorded and flagged by appropriate signals.

5.10.2 During G&N system testing, all interleaved data, Uplink Command Files and Downlink Data File shall be maintained (recorders On). All A/B PCM data that is not made available to the ACE displays shall be verified by requesting a time history data strip out of said data for the time period when the test was performed.

6. DETAILED REQUIREMENTS

6.1 INITIAL TEST CONDITIONS

6.1.1 The IMU shall be supplied with heater power on a continuous basis. The Portable Temperature Controller (Model No. 410-31058) shall be connected at all times although heater power may be supplied from the +28 VDC IMU STANDBY bus and monitored through ACE.

6.1.2 The IMU shall never be without heater power longer than 15 minutes.

6.2.4.6 On K-148 enter the following sequence:

ERROR RESET
VERB 36 ENTR (fresh start)
VERB 57 ENTR
00015 ENTR (clear erasable memory)
VERB 21 NOUN 27 ENTR
77777 ENTR (LGC Self Check)

6.2.4.7 On the CRT, verify that the 3.2 KC 28V Supply indicates between 28.04 and 29.16 VRMS (CG 1331).

6.2.4.8 On the CRT, verify that R1 does not display 01102 or 41102 (indicating a malfunction).

6.2.4.9 Wait 5 minutes then enter the following in K-148.

a.	VERB 34	ENTR
b.	VERB 21 NOUN 27	ENTR
c.	00000	ENTR
d.	VERB 25 NOUN 01	ENTR
e.	03770	ENTR SET LOC.
f.	10067	ENTR CSS NEW JOB
g.	04317	ENTR TC CHANG 1
h.	01770	ENTR TC ACTLITON
i.	VERB 25 NOUN 26	ENTR CALL PRIO/DELAY
j.	01000	ENTR 01 PRIORITY
k.	01770	ENTR RELATIVE E-MEM
m.	00007	ENTR BANK ADD.
n.	VERB 30	ENTR REQ EXEC.

NOTE: If a VERB 36 is performed after the above information has been entered, repeat lines 6.2.4.9.f through 6.2.4.9.j.

6.2.4.10 CAUTION: LGC OPERATE AND IMU STANDBY power must have been applied a minimum of two hours before energizing the IMU OPERATE circuit breaker in step 6.2.4.16 unless all of the following conditions are met:

IF: 1. The G&N System has previously been in Standby Mode at least two hours and subsequently been in Operate Mode, AND

2. The gimbals were placed in a parked position prior to shutdown, AND

3. The shutdown period did not exceed 5 days, AND

4. The Spacecraft or IMU have not been moved in any way during the shutdown period.

THEN: The two-hour standby Mode operation requirement is reduced to 15 minutes.

6.2.4.22 On the CRT, scan the power supply voltages to verify their normal operation. (No indications flashing).

6.2.4.23 After all the tests of 6.3 in Figure 1 have been completed, the General Turn-On Procedure (6.2.4) and IMU Operational Test (6.3.6) shall be completed before re-running any test. Otherwise, the testing sequence shall continue in accordance with Figure 2.

6.2.5 Interruption of Power

6.2.5.1 IMU Operate power shall never be applied without the presence of LGC Operate and IMU Standby Power.

6.2.5.2 The G&N System log book shall include the gimbal positions at time of power shutdown. If omitted, it shall be assumed that the gimbals were not parked prior to shutdown. The log book shall also state if any movement of the IMU or Spacecraft has taken place after shutdown. The times of application and removal of any bus power to the G&N System shall be recorded.

6.2.5.3 After the system has been operating with IMU Operate power on, and a power interruption occurs, immediately set the IMU Operate power circuit breaker to OFF. When power is restored a minimum of 15 minutes operation in Standby Mode is required before resuming IMU Operate power. If the power interruption was longer than 15 minutes, the G&N System shall be run in Standby Mode for a time interval at least equal to the duration power was off before resuming IMU Operate power. However, this period need not exceed two hours before application of IMU Operate power.

6.2.6 A warmup period of at least one hour in Operate mode is required prior to performing any test in which gyro or accelerometer parameters are measured, and at least 15 minutes prior to any test in which precision amplitude and frequency power supply checks are made.

6.3 TEST PROCEDURES

6.3.1 Standby Power On Tests

6.3.1.1 The Portable Temperature Controller, Model No. 400-31058 shall be supplying inertial component heater power to the G&N System through connecter 56J1 (P230). If alarm or fail indications are present on the PTC, they shall be cleared by depressing the SYSTEM RESET pushbutton on the PTC.

6.3.1.2 Verify that spacecraft power checks, including both polarity as well as magnitude on the spacecraft power connectors, have been accomplished.

6.3.1.3 The following switches and/or circuit breakers shall be closed to energize the indicated buses.

LOCATION	NOMENCLATURE	IDENTIFICATION
Panel 14	BAT 5 NORMAL FEED	4S10
Panel 14	BAT 6 NORMAL FEED	4S11
Panel 16	X LUNAR BUS TIE	4CB5
Panel 16	BAT 1-4-6 FEED TIE	4CB17
Panel 16	BAT 2-3-5 FEED TIE	4CB25
Panel 16	ASC ECA	4CB14
Panel 16	ASC ECA CONT.	5CB7
Panel 16	DC BUS VOLT	4CB21
Panel 16	DISP.	4CB16
Panel 11	X LUNAR BUS TIE	4CB4
Panel 11	BAT 1-4-6 FEED TIE	4CB18
Panel 11	BAT 2-3-5 FEED TIE	4CB26
Panel 11	ASC ECA	4CB15
Panel 11	ASC ECA CONT.	4CB6
Panel 11	DC BUS VOLT	4CB22
Panel 16	INV. NO. 2	4CB13
Panel 14	AC PWR to INV 2 Position	4S14
Panel 11	AC BUS FEED TIE	4CB24
Panel 11	AC BUS VOLT	4CB27

6.3.1.4 IMU Standby Power Turn On

6.3.1.4.1 Turn on Event Recorder at a speed of 1 mm/sec.

6.3.1.4.2 Press in +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11. Record time.

6.3.1.4.3 Verify on event recorder that +28 VDC IMU STANDBY power discrete (GG1513) is on. On CRT, +28V IMU STANDBY Bus (GG1510) shall indicate between 24.5 and 33.5.

6.3.1.4.4 The PIPA TEMP displayed on CRT, shall be monitored periodically for one hour to ensure that the PIPA Temperature Control circuitry is operating to maintain a temperature of 130±5.0 DEG F. (GG2300). One hour after performing step 6.3.1.4.2 record PIPA TEMP. The PIPA temperature shall be 130.5° ±1.5°F. The IRIG temperature shall be within +3.0°F of the PIPA Temperature.

6.3.1.5 Computer Power Turn On

6.3.1.5.1 Press in +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11.

6.3.1.5.2 On CRT, +28V LGC Operate Bus (GG1520) shall indicate between 24.5 and 33.5. Ignore computer alarm indications. Verify on event recorder that +28V LGC OP (GG1523X) discrete is ON. Using DSKY, enter VERB 36 ENTR then press RSET. All Computer alarms shall clear.

6.3.1.5.3 On CRT, the +14 VDC LGC SUPPLY (GG1020) shall indicate between 13.6 and 14.4 VDC. Record this value.

6.3.1.5.4 On CRT, the +4 VDC LGC SUPPLY (GG1030) shall indicate between 3.8 and 4.2 VDC. Record this value.

6.3.1.5.5 On CRT the 28V 3200 CPS SUPPLY (GG1331) shall indicate between 28.04 and 29.16 vrms. Record this value.

6.3.1.6 LGC Operational Tests

6.3.1.6.1 DSKY Check

6.3.1.6.1.1 Initiate the DSKY check by entering in the DSKY:

Press ERROR RESET
VERB 57 ENTR 00015 ENTR (clear erasable memory)
VERB 21 NOUN 27 ENTR
00011 ENTR

6.3.1.6.1.2 All the electroluminescent elements (PROG, VERB, NOUN, and Row 1, Row 2, Row 3) shall display the decimal number (9). Including the 9's, each of the following shall be displayed for approximately 5 seconds.

a. 9's
b. 8's
c. 7's
d. 6's
e. 5's
f. 4's
g. 3's
h. 2's
i. 1's
j. 0's
k. Minus signs in Row 1, ROW 2, ROW 3 } On concurrently for 5 seconds
l. VERB-NOUN flashing }
m. COMP ACTY }
o. Plus signs in ROWS 1, 2, and 3 } On concurrently for 5 seconds
p. VERB-NOUN Flashing }
q. COMP ACTY }
r. COMP ACTY - On for 5 seconds then DSKY blanks.

6.3.1.6.1.3 The DSKY pushbuttons shall be checked by entering:

VERB 25 NOUN 01 ENTR
01740 ENTR
+00123 ENTR
-00456 ENTR
-00789 DO NOT press ENTR

The DSKY shall display +00123 in Row 1, -00456 in Row 2, and -00789 in Row 3. Press CLR pushbutton three times on DSKY. Observe that Row 1, Row 2, and Row 3 are blank.

6.3.1.6.2 Lamp Test

6.3.1.6.2.1 Initiate the Lamp Test by entering in the DSKY:

VERB 35 ENTR

6.3.1.6.2.2 The following DSKY displays shall illuminate for approximately 5 seconds. On CAUTION/WARNING panel, the following displays shall illuminate, then extinguish:

LGC
ISS
PGNS

a. UP LINK ACTY
b. NO ATT
c. STBY
d. KEY REL flashing
e. TEMP
f. GIMBAL LOCK
g. PROG
h. RESTART
i. TRACKER
j. OPR ERROR Flashing
k. VERB-NOUN Flashing
l. Plus 88888 in Row 1, Row 2, and Row 3

On concurrently for approximately 5 seconds.

6.3.1.6.3 Uplink Check

6.3.1.6.3.1 On K-START 148; set LOAD/INHIBIT switch to LOAD, set TAPE/KEY switch to KEY, then enter the following:

ERROR RESET
VERB 25 NOUN 01 ENTR
02400 ENTR
+01234 ENTR
-56789 ENTR
+00000 ENTR

6.3.1.6.3.2 Verify the following is displayed on the DSKY.

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.4 Downlink Check

6.3.1.6.4.1 On CRT, DSKY display, verify the following is displayed:

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.5 LGC Self-Check

6.3.1.6.5.1 On K-148;

VERB 36		ENTR
VERB 21	NOUN 27	ENTR
77777		ENTR
VERB 15	NOUN 01	ENTR
01366		ENTR

6.3.1.6.5.2 On the CRT, DSKY display, verify that R1 does not display 01102 or 41102. If a malfunction occurs, the following is displayed:

R1 01102 or 41102
R2 XXXXX c (S FAIL) program address +1 of point of failure
R3 XXXXX number of fails

6.3.1.6.5.3 When R3 = 00002, stop the LGC Self Check by entering in K-148 the following:

VERB 34 ENTR
VERB 21 NOUN 27 ENTR
00000 ENTR

6.3.1.6.6 LGC Standby Check

6.3.1.6.6.1 On K-148 enter the following sequence:

VERB 60 ENTR
Verify on CRT ABL-LGC-STBY is ON

6.3.1.6.6.2 On DSKY depress STBY pushbutton for approximately 3 seconds.

6.3.1.6.6.3 Verify STBY status indicator lamp is ON.

6.3.1.6.6.4 On the CRT, verify the 3.2 KC 28V Supply (GG1331) is between 28.04 and 29.16V RMS.

6.3.1.6.6.5 On DSKY depress STBY pushbutton for approximately 3 seconds to return to LGC OPERATE mode.

6.3.1.6.6.6 Verify STBY status indication lamp is OFF. Press ERROR RESET pushbutton. Enter VERB 61 ENTR on K-148. Verify on CRT ABL-LGC-STBY is OFF.

6.3.1.6.7 Standby/Proceed Check

6.3.1.6.7.1 On K-148 enter the following:

VERB 11 NOUN 10 ENTR
00032 ENTR

6.3.1.6.7.2 On the DSKY press and hold the STBY pushbutton. Verify Row 1 of the DSKY displays 57777.

6.3.2 Alarms and Interrupts Test

6.3.2.1 Parity Fail Test

6.3.2.1.1 On K-148 enter the following sequence

VERB 21 NOUN 02 ENTR
01600 ENTR
33777 ENTR

6.3.2.1.2 On CRT, DSKY display, verify R1 = 33777 and R3 = 01600

6.3.2.1.3 On K-148 enter the following sequence

VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.1.4 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.1.5 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.2 Rupt Lock-Interrupt Too Long

6.3.2.2.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
00001 ENTR
01600 ENTR
00003 ENTR
VERB 31 ENTR

6.3.2.2.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.2.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.3 TC Trap Test

6.3.2.3.1 On K-148 enter the following sequence

VERB 21 NOUN 01 ENTR
01600 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.3.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.3.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.4 Nightwatchman Test

6.3.2.4.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
03400 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.4.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.4.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.3 IMU OPERATE POWER ON TESTS

NOTE: Perform the following DSKY entries before continuing. If a VERB 36 is performed after the above information has been entered repeat lines f through j.

a.	VERB 25 NOUN 01	ENTR
b.	03770	ENTR SET LOC
c.	10067	ENTR CCS NEW JOB
d.	04317	ENTR TC CHANG 1
e.	01770	ENTR TC ACTLITON
f.	VERB 25 NOUN 26	ENTR CALL PRIO/DELAY
g.	01000	ENTR 01 PRIORITY
h.	01770	ENTR RELATIVE E-MEM
i.	00007	ENTR BANK ADD
j.	VERB 30	ENTR REQ EXEC.

CAUTION

Prior to application of IMU OPERATE power in step 6.3.3.1.4, LGC OPERATE and IMU STANDBY power must have been applied to the G&N System continuously for a minimum of two hours. The only exception is when the requirements of step 6.2.4.10 are met and this does not apply for the initial application of IMU OPERATE power.

6.3.3.1 Verification of Power Turn-On

6.3.3.1.1 Set up analog recorder to monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps
h.	SPARE	

6.3.3.1.2 Start analog recorder to a chart speed of 5 mm/sec. Start event recorder at a chart speed of 1 mm/sec.

6.3.3.1.3 On CRT, monitor +120 VDC PIPA SUPPLY (GG1040) and IMU gimbal angles.

6.3.3.1.4 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.3.3.1.4.1 Verify that the NO ATT Light on the DSKY is lighted.

6.3.3.1.5 Verify on analog recorder that the oscillations of the resolver sine signals (GG2112, GG2172, and GG2142) are not sustained and that the signals damp out within 15 seconds. If they don't, remove IMU OPERATE power as soon as possible.

6.3.3.1.6 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.3.3.1.4 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.3.3.1.4.

6.3.3.1.7 On event recorder verify the following:

LGC WARNING is OFF (GG9001)
ISS WARNING is OFF (GG9002)
PGNCS CAUTION is OFF (GG9003)

6.3.3.1.7.1 On DSKY, verify that the NO ATT light is off.

6.3.3.1.8 On CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.3.1.9 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.4 Temperature Control Verification

6.3.4.1 When 15 minutes have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP (GG2300). The measured temperature shall be within 0.5° of PIPA TEMP measured in 6.3.1.4.5.

6.3.4.2 When 30 minutes have elapsed from the time of IMU OPERATE power turn-on record IRIG TEMP (GG2301).

6.3.4.3 When 1 hour has elapsed from the time of IMU OPERATE power turn-on, monitor PIPA TEMP (GG2300) and IRIG TEMP (GG2301) on the CRT. Monitor and record temperature readings every 5 minutes for 30 minutes. Verify that each reading does not deviate from the average value of each signal by more than 0.1°F.

6.3.4.4 The PIPA temp shall be 130.5 (±1.5°)F. The IRIG TEMP shall be 135°(±2.5°)F.

6.3.4.5 The PIPA TEMP recorded in step 6.3.4.4 shall be within 1.0°F of the temperature recorded in step 6.3.1.4.5 and within 0.5° of the temperature recorded in 6.3.4.1.

6.3.4.6 The IRIG TEMP recorded in step 6.3.4.4 shall be within 0.5°F of the tamperature recorded in step 6.3.4.2.

6.3.5 PGNCS Power Supply Tests

6.3.5.1 From the CRT, confirm power supply voltages (or temperatures) are as specified and record values observed.

6.3.5.2 The PIPA Calibration Module Temperature (GG6020) shall be between +45 and +90 DEG F.

6.3.5.3 The PSA Temperature (GG6021) shall be between +60 and +110 DEG F.

6.3.5.4 The LGC Temperature (GG4300) shall be between +45 and +130 DEG. F.

6.3.5.5 The +28 VDC IMU OPERATE BUS (GG1500) shall be between 24.5 and 33.5 VDC.

6.3.5.6 The +28 VDC IMU STANDBY BUS (GG1510) shall be between 24.5 and 33.5 VDC.

6.3.5.7 The +28 VDC LGC OPERATE BUS (GG1520) shall be between 24.5 and 33.5 VDC.

6.3.5.8 The +120 VDC PIPA Supply (GG1040) shall be between 114 and 126 VDC.

6.3.5.9 The -28 VDC Supply (GG1100) shall be between -21.5 and -33.5 VDC.

6.3.5.10 The +4 VDC CDU Supply (GG1070) shall be between 3.8 and 4.2 VDC.

6.3.5.11 The IMU 28V 800 CPS 1 pct Supply (GG1201) shall be between 27.44 and 28.56 VRMS.

6.3.5.12 The IMU 28V 800 CPS 5 pct 90 PH Supply (GG1202) shall be between 26.6 and 29.4 VRMS.

6.3.5.13 The IMU 28V 800 CPS 5 pct 0 PH Supply (GG1203) shall be between 25.9 and 30.1V RMS.

6.3.5.14 The 3.2 KC 28V Supply (GG1331) shall be between 28.04 and 29.16V RMS.

6.3.5.15 The 2.5 VDC T/M Bias (GG1110) shall be between 2.4 and 2.6 VDC.

6.3.5.16 The +14 VDC LGC Supply (GG1020) shall be between 13.6 and 14.4 VDC.

6.3.5.17 The +4 VDC LGC Supply (GG1030) shall be between 3.8 and 4.2 VDC.

6.3.5.18 The phase difference between the 3.2 KC supply and LGC sync shall be 0° ±10° (NG1336).

6.3.5.19 Record the noise levels of the following signals displayed on the CRT.

Item No.	Measurement No.	Signal	Requirement
a.	NG 1021	14 vdc LGC Noise rms	<0.4V rms
b.	NG 1031	4 vdc LGC Noise rms	<0.4V rms
c.	NG 1071	4 vdc CDU Noise rms	<1.0V rms
d.	NG 1501	28 vdc IMU Operate Noise rms	<1.0V rms
e.	NG 1511	28 vdc IMU Standby Noise rms	<1.0V rms
f.	NG 1521	28 vdc LGC Operate Noise rms	<2.0V rms

6.3.5.20 The noise peaks of the following signals are demonstrated on the event lights when the peaks have a rise time between 2 and 50 usec and the peak voltage exceeds 5 volts.

Item No.	Measurement No.	Signal
a.	NG 1022	14 vdc LGC Noise Peak
b.	NG 1032	4 vdc LGC Noise Peak
c.	NG 1072	4 vdc CDU Noise Peak
d.	NG 1502	28 vdc IMU Operate Noise Peak
e.	NG 1512	28 vdc IMU Standby Peak
f.	NG 1522	28 vdc LGC Operate Peak

6.3.6 IMU OPERATIONAL TEST

6.3.6.1 On K-148 enter the following:

VERB 01 NOUN 10 ENTR
00003 ENTR
Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.6.2 On K-148 enter the following:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 02 ENTR
01300 ENTR
Record CRT DSKY Row 1 indication as ±BBBBB

6.3.6.3 Perform the following calculations:

a. $\frac{\text{BBBBB} \times 5.12}{3600}$ = CCCC.C (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours

c. DDD.D + time of day recorded in 6.3.6.1 = time of day at which high order scalar register will overflow.

6.3.6.4 If time of day is within 12 minutes of that calculated in 6.3.6.3.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.6.3.c has passed and proceed.

6.3.6.5 In K-148 enter the following sequence:

VERB 57 ENTR
00004 ENTR

6.3.6.6 Wait 200 seconds, then verify on the CRT, that the X, Y and Z PIPA SG Output signals all indicate 0.0±2.5 Volts but not 0.

6.3.6.7 Approximately 12 minutes after performing step 6.3.6.1, VERB 06 NOUN 66 shall flash.

6.3.6.8 From the CRT, DSKY display, read and record R1 and R2 (local gravity whole and fractional respectively). The value recorded shall be between 975.0 and 985.9 cm/sec^2.

6.3.6.9 On K-148 enter the following sequence.

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.6.10 From the CRT, DSKY display, read and record the horizontal fractional component of earth rate acting on the X, Y, and Z IRIG's as displayed in R2. The value recorded shall be between .65750 and .85750.

6.3.6.11 Terminate the test by entering in K-148 the following:

VERB 33 ENTR
VERB 16 NOUN 40 DISPLAYED
VERB 34 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.7 PGNCS Operational Test

6.3.7.1 Start the PGNCS Operational test by inserting the following sequence into K-148:

VERB 57 ENTR
00010 ENTR
Program 07 shall be displayed
VERB 33 NOUN 01 is displayed flashing

6.3.7.2 Command Accuracy 0°

6.3.7.2.1 On K-148, press ENTR

VERB 33 NOUN 02 is displayed flashing
On Event Module ISS WARNING Lamp may light
Press ENTR [illegible]
VERB 33 NOUN 03 is displayed flashing

6.3.7.2.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 000±001 degrees.

6.3.7.2.3 Read and record CRT the DSKY Row 1, 2, and 3 indications. The indications shall be +00000±00007.

6.3.7.3 Command Accuracy 45°

6.3.7.3.1 On K-148, press ENTR, VERB 33 NOUN 04 is displayed flashing after approximately 20 seconds.

6.3.7.3.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 045±001 degrees.

6.3.7.3.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +04500±00007.

6.3.7.4 CDU Repeating Accuracy 45°

6.3.7.4.1 On K-148 press ENTR. In about 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.4.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.5 Command Accuracy 90°

6.3.7.5.1 On K-148 Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 06 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.5.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 090±001 degrees.

6.3.7.5.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be +09000±00007.

6.3.7.6 Command Accuracy 135°

6.3.7.6.1 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 07 is displayed flashing.

6.3.7.6.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 135±001 degrees.

6.3.7.6.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +13500±00007.

6.3.7.7 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 10 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.8 CDU Repeating Accuracy 135°

6.3.7.8.1 On K-148 press ENTR pushbutton. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.8.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.9 + Gimbal Lock Test

6.3.7.9.1 On K-148, Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 12 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.10 Command Accuracy 225°

6.3.7.10.1 On K-148 press ENTR. In approximately 20 seconds, VERB 33, NOUN 13 is displayed flashing.

6.3.7.10.2 Read and record the CRT indication of IMU gimbal angles. The indication shall be 225±001 degrees.

6.3.7.10.3 Read and record CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +225±00007.

6.3.7.11 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 14 is displayed. The GIMBAL LOCK lamp shall not be lighted.

6.3.7.12 CDU Command Rate Test

6.3.7.12.1 On K-148 press ENTR. In approximately 30 seconds VERB 06 NOUN 66 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.12.2 Read and record the CRT DSKY Row 1, 2, and 3 indications. The indication shall be between 00012 and 00016.

6.3.7.12.3 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.12.4 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on the DSKY shall not be lighted.

6.3.7.13 Command Accuracy 315°.

6.3.7.13.1 On K-148 insert VERB 33 ENTR. In approximately 20 seconds VERB 33 NOUN 20 will be displayed flashing.

6.3.7.13.2 Read and record CRT indication of IMU gimbal angles. The indications shall be 315±001 degrees.

6.3.7.13.3 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indications shall be +315±00007.

6.3.6.14 CDU Repeating Accuracy 315°

6.3.7.14.1 On K-148 press ENTR. In approximately 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.14.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.15 -Gimbal Lock Test

6.3.7.15.1 On K-148 Press VERB 33 ENTR. In approximately 20 seconds VERB 33, NOUN 22 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.15.2 On K-148 Press ENTR. In approximately 20 seconds VERB 33 NOUN 23 will be displayed flashing. <

6.3.7.15.3 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indications shall be

Row 1	22500±00007
Row 2	22500±00007
Row 3	00000±00007

6.3.7.16 CDU Repeating Accuracy 225°

6.3.7.16.1 On K-148, press ENTR. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.16.2 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indication shall be between 77774 and 00003.

6.3.7.17 On K-148 Press VERB 33 ENTR. The GIMBAL LOCK lamp shall not be lighted. VERB 21, NOUN 22 is displayed flashing.

6.3.7.18 IMU CDU Fine Fail Test

6.3.7.18.1 On K-148 insert the following sequence

+00100 ENTR
+00100 ENTR
+00100 ENTR
On Event Module verify that ISS WARNING lamp lights.

6.3.7.18.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display Row 1 indicates 33XXX or 32XXX.

6.3.7.19 IMU CDU Coarse Fail Test

6.3.7.19.1 On K-148 insert the following sequence

VERB 33 ENTR
+03750 ENTR
+03750 ENTR
+03750 ENTR
Verify that ISS WARNING lamp Event Module lights.

6.3.7.19.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display of Row 1 indicates 33XXX or 32XXX.

6.3.7.20 FDAI Linearity Test

6.3.7.20.1 On K-148 enter VERB 33 ENTR
VERB 33 NOUN 27 shall be displayed.

6.3.7.20.2 On CRT verify the following:

PITCH ATT ERROR is between +15.3 and +18.7 DEG (GG2219)
YAW ATT ERROR is between +15.3 and +18.7 DEG (GG2249)
ROLL ATT ERROR is between +15.3 and +18.7 DEG (GG2279)

6.3.7.20.3 On K-148 press ENTR.
VERB 33 NOUN 30 shall be displayed.

6.3.7.20.4 On CRT verify the following:

PITCH ATT ERROR is between +14.4 and +17.6 DEG (GG2219)
YAW ATT ERROR is between +14.4 and +17.6 DEG (GG2249)
ROLL ATT ERROR is between +14.4 and +17.6 DEG (GG2279)

6.3.7.20.5 On K-148 press ENTR.
VERB 33 NOUN 31 shall be displayed

6.3.7.20.6 On CRT verify the following:

PITCH ATT ERROR is between +05.4 and +06.6 DEG (GG2219)
YAW ATT ERROR is between +05.4 and +06.6 DEG (GG2249)
ROLL ATT ERROR is between +05.4 and +06.6 DEG (GG2279)

6.3.7.20.7 On K-148 press ENTR.
VERB 33 NOUN 32 shall be displayed.

6.3.7.20.8 On CRT verify the following:

PITCH ATT ERROR is between +00.2 and -00.2 DEG (GG2219)
YAW ATT ERROR is between +00.2 and -00.2 DEG (GG2249)
ROLL ATT ERROR is between +00.2 and -00.2 DEG (GG2279)

6.3.7.20.9 On K-148 press ENTR.

VERB 33 NOUN 33 shall be displayed.

6.3.7.20.10 On CRT verify the following:

PITCH ATT ERROR is between -05.4 and -06.6 DEG (GG2219)
YAW ATT ERROR is between -05.4 and -06.6 DEG (GG2249)
ROLL ATT ERROR is between -05.4 and -06.6 DEG (GG2279)

6.3.7.20.11 On K-148 press ENTR.
VERB 33 NOUN 34 shall be displayed.

6.3.7.20.12 On CRT verify the following:

PITCH ATT ERROR is between -14.4 and -17.6 DEG (GG2219)
YAW ATT ERROR is between -14.4 and -17.6 DEG (GC2249)
ROLL ATT ERROR is between -14.4 and -17.6 DEG (GG2279)

6.3.7.20.13 On K-148 press ENTR.
VERB 33 NOUN 35 shall be displayed.

6.3.7.20.14 On CRT verify the following:

PITCH ATT ERROR is between -15.3 and -18.7 DEG (GG2219)
YAW ATT ERROR is between -15.3 and -18.7 DEG (GG2249)
ROLL ATT ERROR is between -15.3 and -18.7 DEG (GG2279)

6.3.7.21 On K-148 enter VERB 36 ENTR. The proper operation of the IMU CAGE function (consisting of steps 6.3.7.21 thru 6.3.7.23) need be performed only once during the initial PGNCS Operational Test and omitted from subsequent testing of test 6.3.7.

6.3.7.21.1 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00500 ENTR
+00500 ENTR
+00500 ENTR

6.3.7.21.2 On the CRT, verify all IMU gimbal angles indicate between 003 and 007 DEG.

6.3.7.21.3 On analog recorder, monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps

6.3.7.21.4 Start analog recorder to a chart speed of 5 mm/sec.

6.3.7.21.5 On LEM Cabin Panel 4, hold IMU CAGE momentary toggle switch in the ON position. (Do not release).

6.3.7.21.6 On analog recorder, verify the 1X Resolver Sine signals (GG2112, GG2172, GG2142) null out to less than 0.5V rms. Release IMU CAGE switch to the OFF position. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Any sustained oscillations shall be cause for immediate removal of IMU Operate power.

6.3.7.21.7 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.7.22 Stop analog recorder.

6.3.7.22.1 On K-148 insert the following:

VERB 43 ENTR
+01700 ENTR
+00600 ENTR
-01700 ENTR

On CRT verify the following:

YAW ATT ERROR is between +15.3 and +18.7 Deg. (GG2249).
PITCH ATT ERROR is between +05.4 and +06.6 Deg (GG2219).
ROTT ATT ERROR is between -15.3 and -18.7 Deg (GG2279).

6.3.7.23

VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00800 ENTR
+00100 ENTR
-00800 ENTR

6.3.7.24 On CRT verify the following:

OG 1X Resolver Sin (1°F) is between +06.50° and +09.50° (GG2181).
IG 1X Resolver Sin (19°) is between -00.50 and +02.50 Deg (GG2121)
MG 1X Resolver Sin (11°) is between -06.50 and -09.50 Deg (GG2151).

6.3.7.25 On K-148 enter the following:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.8 IRIG Scale Factor Determination

6.3.8.1 Insure that the IMU Operate power and LGC Operate power have been applied for a minimum of one hour and that the IMU is not in a gimbal lock condition.

6.3.8.2 On meter module monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.8.3 On K-148 enter the following sequence:

VERB 57 ENTR
00005 ENTR

6.3.8.4 PROG 07 shall be displayed.

6.3.8.5 VERB 06 NOUN 61 shall flash.

6.3.8.6 On the CRT DSKY, Verify contents of Row 1 (Navigation Base azimuth) and Row 2 (Site latitude shall be displayed).

6.3.8.7 If values for Row 1 and Row 2 are correct, proceed to the next step.
If values for Row 1 and Row 2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR
±xxxxx ENTR (Correct navigation base azimuth)
+40748 ENTR (Correct site latitude)
Verify values in Row 1 and Row 2 are correct.

6.3.8.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.8.

6.3.8.9 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (-X IRIG Scale Factor error in part per million, Position +00001)

6.3.8.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.10.

6.3.8.11 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (-Y IRIG Scale Factor error in parts per million, Position +00002).

6.3.8.12 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.12.

6.3.8.13 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position +00003).

6.3.8.14 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.14.

6.3.8.15 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row (+X IRIG Scale Factor error in parts per million, Position -00001).

6.3.8.16 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.16.

6.3.8.17 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor error in parts per million, Position -00002).

6.3.8.18 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM is ON, enter VERB 36 ENTR and repeat steps, 6.3.8.3 through 6.3.8.7 and 6.3.8.18.

6.3.8.19 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (-Z IRIG Scale Factor error in parts per million, Position -00003).

6.3.8.20 Repeat steps 6.3.8.8 through 6.3.8.19 twice to obtain second and third set of data.

6.3.8.21 Terminate this test by entering in K-148 the following:

VERB 34 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.8.22 The average of the three readings of Scale Factor Error for each of the 6 positions shall be 0 ± 1750 PPM.

6.3.9 IMU Performance Test. A reference data sheet is provided at the end of this section to aid in data reduction. [illegible]

6.3.9.1 Insure that IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.9.2 On CRT display, monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.9.3 Adjust oscilloscope to display butterfly of X PIPA.

6.3.9.4 On K-148 enter the following:

VERB 01 NOUN 10 ENTR
00003 ENTR
Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.9.5 On K-148 enter the following:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 02 ENTR
01300 ENTR
Record CRT DSKY Row 1 indications as ±BBBBB.

6.3.9.6 Perform the following calculations:

a. $\frac{\text{BBBBB} \times 5.12}{3600}$ = CCCC.C (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours.

c. DDDD.D + present time of day = time of day at which high order scalar register will overflow.

6.3.9.7 If the time of day is within 12 minutes of that calculated in 6.3.9.6.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.9.6.c has passed and proceed.

Paragraph

6.3.9.15
6.3.9.22
6.3.9.30
6.3.9.36
6.3.9.43
6.3.9.48

6.3.9.8 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTR
00370 ENTR
Record contents of CRT DSKY Row 1 XXXXY
VERB 21 NOUN 01 ENTR
00370 ENTR
XXXXY' ENTR
Where Y' is obtained from Table 1a.
VERB 57 ENTR
00001 ENTR
VERB 06 NOUN 61 shall flash

6.3.9.9 On the CRT, DSKY display verify R1 (Navigation Base Azimuth) and R2 (Site Latitude) are correct.

6.3.9.10 If values for R1 and R2 are correct, proceed to next step.
If values for R1 and R2 are incorrect, enter the following sequence into K-148.

VERB 24 ENTR
±xxx.xx ENTR (Correct navigation base azimuth ±0.50 deg)
+40.748 ENTR (Correct site latitude)
Verify values in R1 and R2 are correct.

6.3.9.11 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.12 On CRT, DSKY display, verify R1 = +00600 (Time), R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position).
If values for R1, R2 and R3 are correct, proceed to next step.
If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00600 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00001 ENTR (Test Position Entry)

6.3.9.13 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.14 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 (+NBDY Position +00001).

6.3.9.15 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.16 After 100 seconds, take a photograph of Y and Z PIPA butterfly patterns on oscillescope.

6.3.9.17 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (+X PIPA Position +00001). Row 1 is whole part, Row 2 is fractional part. Units are cm/sec^2.

6.3.9.18 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.19 On CRT, DSKY display - verify R1 = +00600, R2 = +00000, and R3 = +00002.

6.3.9.20 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.21 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDZ Position +00002).

6.3.9.22 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.23 Approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (-X PIPA Position +00002).

6.3.9.24 On K-148 enter the following sequence:

VERB 33 ENTR
Record CRT CDU gimbal angle indications and time.

6.3.9.25 In approximately 67 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX + ADIAX Pos +00002). Record CRT CDU gimbal angle indications and time.

6.3.9.26 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.27 On CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00003.

6.3.9.28 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.29 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX Position +00003).

6.3.9.30 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.31 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Z PIPA Position +00003).

6.3.9.32 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.33 On the CRT, DSKY display verify R1 = +00600, R2 = 00000, and R3 = +00004.

6.3.9.34 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.35 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDY + ADSRAY Position +00004).

6.3.9.36 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.37 After 100 seconds, take a photograph of the X-PIPA butterfly pattern on oscilloscope.

6.3.9.38 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (-Z PIPA Position +00004).

6.3.9.39 On K-148 enter the following sequence:

VERB 33 ENTR

Record CRT CDU gimbal angle indications and time.

6.3.9.40 In approximately 67 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display record R2 (+NBDZ + ADIAZ Position +00004). Record CRT CDU gimbal angle indications and time.

6.3.9.41 On K-148 enter the following sequence:

VERB 33	ENTR
VERB 06	NOUN 66 shall flash

6.3.9.42 From the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00005.

6.3.9.43 On K-148 enter the following sequence:

VERB 33	ENTR

6.3.9.44 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.45 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Y PIPA Position +00005).

6.3.9.46 On K-148 enter the following sequence:

VERB 34	ENTR
VERB 06	NOUN 66 shall flash

6.3.9.47 On the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00006.

6.3.9.48 On K-148 enter the following sequence:

VERB 33	ENTR

6.3.9.49 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.50 In approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2. (-Y PIPA Position +00006).

6.3.9.51 On K-148 enter the following sequence:

VERB 34	ENTR
VERB 06	NOUN 66 shall flash

6.3.9.52 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000 and R3 = +00007.

6.3.9.53 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.54 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+.707 ADSRAX-NBDX Position +00007).

6.3.9.55 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.56 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00008.

6.3.9.57 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.58 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 [-.707 (NBDZ+NBDY) +0.5 (ADIAZ - ADIAY) +0.5 (ADSRAY + ADSRAZ)] (Position + 00008).

6.3.9.59 On K-148 enter the following:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.60 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00009.

6.3.9.61 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.62 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display, record R2 (-NBDZ + .707 ADSRAZ Position +00009).

6.3.9.63 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.64 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00010.

6.3.9.65 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.66 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 [.707 (NBDY-NBDX) +.5 (ADIAY - ADIAX) +.5 ADSRAX] (Position +00010).

6.3.9.67 Terminate this test by entering in K-148 the following:

VERB 36 ENTR

6.3.9.68 On CRT, record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).

6.3.9.69 On K-148 enter the following sequence:
VERB 41 NOUN 20 ENTER
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.9.70 Calculations

NOTE: Use Post Vibration or System Test data points only.

6.3.9.70.1 Obtain data from last IRIG and/or PIPA test and fill in Data Sheet x_{i-1}.

6.3.9.70.2 Obtain data from second last IRIG and/or PIPA test and fill in Data Sheet x_{i-2}.

6.3.9.70.3 Obtain data from third last IRIG and/or PIPA test and fill in Data Sheet x_{i-3}.

6.3.9.70.4 Perform the following calculations for each item appearing on Data Sheet x_i and transfer all results to lines au through bi.

NOTE:

See paragraph 5.6 before continuing

$$D_1 = \left| x_{i-1} - x_i \right|$$

$$D_2 = \left| x_{i-1} - x_i \right| + \left| x_{i-2} - x_{i-1} \right|$$

$$D_3 = \left| x_{i-3} - x_{i-2} \right| + \left| x_{i-2} - x_{i-1} \right| + \left| x_{i-1} - x_i \right|$$

6.3.10 LGC Voltage Margin Test

6.3.10.1 Initial Conditions

6.3.10.1.1 Insure that the G&N System is in the Standby Mode.

6.3.10.1.2 On the CRT, verify the +28 VDC LGC OPERATE bus is between 24.5 and 33.5 vdc (GG 1520).

6.3.10.2 Voltage Margin Determination

6.3.10.2.1 On the PSA Adapter Module (PSAAM) (410-31080), place INHIBIT VOLTAGE FAIL switch to ON.

CAUTION: The +4 vdc LGC Supply voltage shall never be operated lower than +2.5 vdc or higher than +5.2 vdc (GG1030).

The +14 vdc LGC Supply shall never be operated less than +8.5 vdc or higher than +17.0 vdc (GG 1020).

NOTE: The flashing indication of the LGC supplies may be disregarded for this test. The charts in Table II may be used to determine approximate values for "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9. 14	+N BDY Position +00001 Transfer result to line af	meru	( ) ---.--	a.
6.3.9. 17	+X PIPA Test Position +00001	cm/sec^2	( ) 00---. ( )-----	b.
6.3.9. 21	+N BDZ Position +00002 Transfer result to line ag	meru	( ) ---.--	c.
6.3.9. 23	-X PIPA Test Position +00002	cm/sec^2	( ) 00---. ( )-----	d.
6.3.9. 25	-N BDX + ADIAX Position +00002	meru	( ) ---, --	e.
6.3.9. 29	-N BDX Position +00003 Multiply by -1 and transfer result to line ah	meru	( ) ---.--	f.
6.3.9. 31	+Z PIPA Test Position +00003	cm/sec^2	( ) 00---. ( ) -----	g.
6.3.9. 35	+N BDY + ADSRAY Position +00004	meru	( ) ---.--	h.
6.3.9. 38	-Z PIPA Test Position +00004	cm/sec^2	( ) 00---. ( ) -----	i.
6.3.9. 40	+N BDZ + ADIAZ Position +00004	meru	( ) ---.--	j.
6.3.9. 45	+Y PIPA Test Position +00005	cm/sec^2	( ) 00---. ( ) -----	k.
6.3.9. 50	-Y PIPA Test Position +00006	cm/sec^2	( ) 00---. ( ) -----	l.

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9.54	-NBDX+ .707 ADSRAX Position +00007	meru		m.
6.3.9.58	-.707 (NBDZ+NBDY) +0.5 (ADIAZ-ADIAY) +0.5 (ADSRAY+ADSRAZ) Position +00008	meru		n.
6.3.9.62	-NBDZ+.707ADSRAZ Position +00009	meru		o.
6.3.9.66	.707(NBDY-NBDX) +.5 (ADIAY-ADIAX) +.5 ADSRAX Position +00010	meru		p.

DATA SHEET

CALCULATION	PARAMETER	UNITS	
line c − line f = ( ) ---.-- (−NBDX+ADIAX) − (−NBDX) Transfer result to line al.	ADIAX	meru	q
line h − line a = ( ) ---.-- (+NBDY+ADSRAY) − (+NBDY) Transfer result to ai.	ADSRAY	meru	r
line j − line c = ( )---.--- (+NBDZ+ADIAZ) − (NBDZ) Transfer result to line am.	ADIAZ	meru	s
(line m − line f)X1.414 = ( ) ---.-- [(−NBDX + .707 ADSRAX) − (−NBDX)] X 1.414 Transfer result to line ak.	ADSRAX	meru	t
(line o + line c) X1.414 = ( ) ---.-- (−NBDZ + .707 ADSRAZ + NBDZ) X1.414 Transfer result to line aj.	ADSRAZ	meru	u
(line p − .707 line a − .707 line f +.5 line q −.5 line t) X2 = ---.-- [.707 (NBDY−NBDX) +.5 (ADIAY−ADIAX) +.5 ADSRAX −.707 (−NBDX) −.707 NBDY +.5 ADIAX−.5 ADSRAX] X2 Transfer result to line an.	ADIAY	meru	v
line b − line d = ( )	PIPA X2G	cm/sec^2	w
line k − line l = ( )	PIPA Y2G	cm/sec^2	x
line g − line i = ( )	PIPA Z2G	cm/sec^2	y
1960.52 ÷ line w x 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line ao.	X PIPA S. F.	cm/sec/ pulse	z
1960.52 ÷ line x X 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line ap.	Y PIPA S. F.	cm/sec/ pulse	aa
1960.52 ÷ line y X 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line aq.	Z PIPA S. F.	cm/sec/ pulse	ab
1/2 (line b + line d) = ( ) --.-- Transfer results to line ar	X PIPA Bias	cm/sec^2	ac
1/2 (line k + line l) = ( ) --.--- Transfer results to line as	Y PIPA Bias	cm/sec^2	ad
1/2 (line g + line i) = ( ) --.--- Transfer results to line at	Z PIPA Bias	cm/sec^2	ae

TABLE I

Y	Y'
0	2
1	3
2	2
3	3
4	6
5	7
6	6
7	7

DATA SHEET
(x_i)

PARAMETER	UNITS	MIN VALUE	RECORDED VALUE	MAX VALUE	REJ	ACC	
NBDY	meru	-15		+15			af
NBDZ	meru	-15		+15			ag
NBDX	meru	-15		+15			ah
ADSRAY	meru	-40		+40			ai
ADSRAZ	meru	-40		+40			aj
ADSRAX	meru	-40		+40			ah
ADIAX	meru	-100		+100			al
ADIAZ	meru	-100		+100			am
ADIAY	meru	-100		+100			an
X PIPA S. F. error from line z	PPM	-1900		+1900			ao
Y PIPA S. F. error from line aa	PPM	-1900		+1900			ap
Z PIPA S. F. error from line ab	PPM	-1900		+1900			aq
X PIPA Bias from line ac	cm/sec^2	-3.1		+3.1			ar
Y PIPA Bias from line ad	cm/sec^2	-3.1		+3.1			as
Z PIPA Bias from line ae	cm/sec^2	-3.1		+3.1			at

DATA SHEET

(x_{i-1})

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru	
ADSRAZ	meru	
ADSRAX	meru	
ADIAX	meru	
ADIAZ	meru	
ADIAY	meru	
X PIPA S. F. error	PPM	
Y PIPA S. F. error	PPM	
Z PIPA S. F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET
(x_i-2)

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru	
ADSRAZ	meru	
ADSRAX	meru	
ADIAX	meru	
ADIAZ	meru	
ADIAY	meru	
X PIPA S. F. error	PPM	
Y PIPA S. F. error	PPM	
Z PIPA S. F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET
(x_{1-3})

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru	
ADSRAZ	meru	
ADSRAX	meru	
ADIAX	meru	
ADIAZ	meru	
ADIAY	meru	
X PIPA S. F. error	PPM	
Y PIPA S. F. error	PPM	
Z PIPA S. F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET

PARAMETER	UNITS	D_1	MAX	D_2	MAX	D_3	MAX	
NBDY	meru		6		9		11	au
NBDZ	meru		6		9		11	av
NBDX	meru		6		9		11	aw
ADSRAY	meru		14		21		25	ax
ADSRAZ	meru		14		21		25	ay
ADSRAX	meru		14		21		25	az
ADIAX	meru		17		33		40	ba
ADIAZ	meru		17		33		40	bb
ADIAY	meru		17		33		40	bc
X PIPA S. F.	Error PPM		400		500		600	bd
Y PIPA S. F.	Error PPM		400		500		600	be
Z PIPA S. F.	Error PPM		400		500		600	bf
X PIPA Bias	cm/sec^2		0.5		0.7		0.9	bg
Y PIPA Bias	cm/sec^2		0.5		0.7		0.9	bh
Z PIPA Bias	cm/sec^2		0.5		0.7		0.9	bi

6.3.10.2.2 Enter 0001 into R155. Verify and execute.

6.3.10.2.3 Enter 1111 into R154. Verify and execute.

6.3.10.2.4 Enter in C-156 ±XX.X001114. (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 12.1 (+0.3, -0) vdc. See Table II). Execute.

6.3.10.2.5 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the +4V power supply (GG 1030) as monitored on the CRT, to 3.5 (+0.15, -0) vdc. See Table II). Execute.

6.3.10.2.6 On K-148 press ERROR RESET.

6.3.10.2.7 On K-148 initiate LGC Self-Check by entering the following:

VERB 21 NOUN 27 ENTR
77767 ENTR

Wait 200 seconds. Verify RESTART lamp on the DSKY is not lit.

6.3.10.2.8 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.9 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations.

VERB 21 NOUN 27 ENTR
77767 ENTR

6.3.10.2.10 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 16.4 (+0, -0.4) vdc. See Table II. Execute.

6.3.10.2.11 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.12 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations.

VERB 21 NOUN 27 ENTR
77767 ENTR

6.3.10.2.13 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the 4V power supply (GG 1030) as monitored on the CRT, to 4.5 (+0, -0.2) vdc. See Table II). Execute.

6.3.10.2.14 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.

6.3.10.2.15 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lit. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:

```
VERB 21 NOUN 27 ENTR
77767           ENTR
```

6.3.10.2.16 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the 14V power supply (GG 1020) as monitored on the CRT, to 12.1 (+0.3, -0) vdc. See Table II). Execute.

6.3.10.2.17 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.18 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.19 On R-154 enter 0000. Execute.

6.3.10.2.20 On R-155 enter 0000. Execute.

6.3.10.2.21 On K-148 terminate the LGC Self-Check by entering the following:

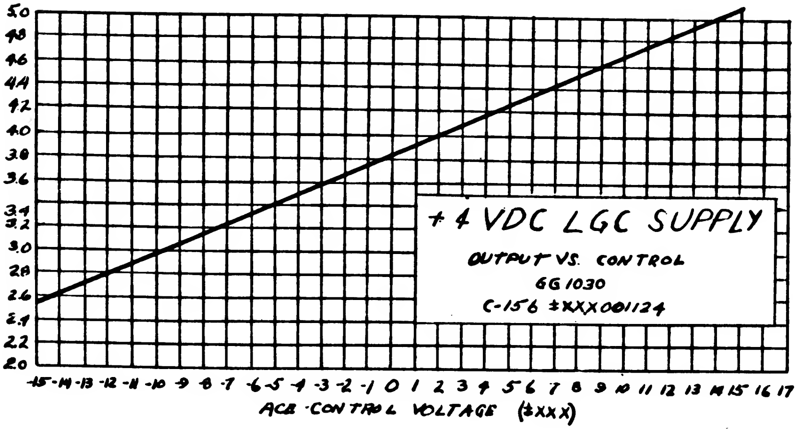
```
VERB 21  NOUN 27  ENTR
00000             ENTR
```

6.3.10.2.22 On K-148 press ERROR RESET.

6.3.11 LGC Clock Frequency Test

6.3.11.1 Insure that LGC Operate power has been applied for a minimum of 10 minutes before performing this test.

6.3.11.2 Verify that the counter is connected to the 3.2kc signal on the hardline.


5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
+4 VDC LGC SUPPLY
OUTPUT VS. CONTROL
GG1030
C-156 ±XXX001124
-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
ACE CONTROL VOLTAGE (±XXX)

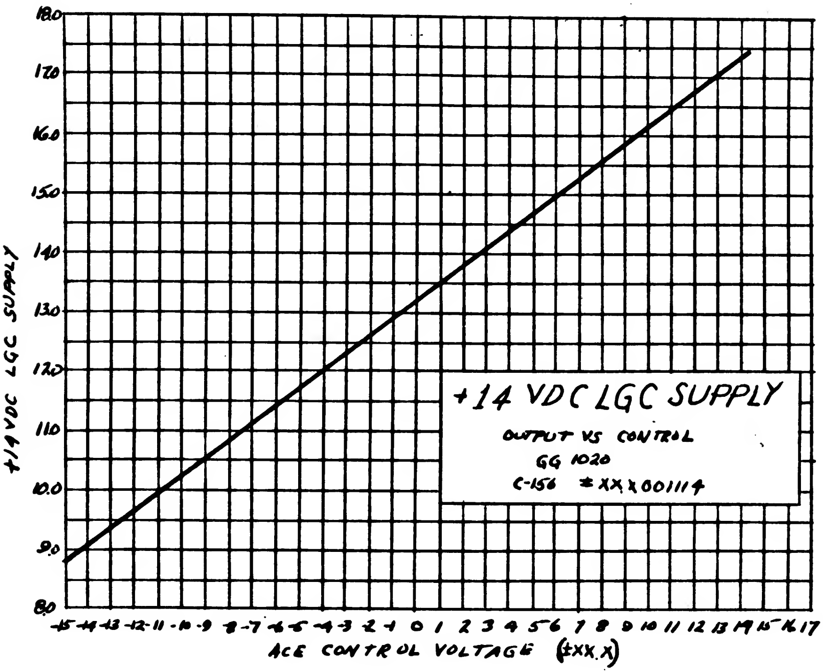

18.0
170
16.0
15.0
140
13.0
120
110
10.0
9.0
8.0
+14 VDC LGC SUPPLY
+14 VDC LGC SUPPLY
OUTPUT VS CONTROL
GG 1020
C-156 ±XXX001114
-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
ACE CONTROL VOLTAGE (±XX.X)

TABLE II

6.3.11.3 Insure that the counter has been warming up for a minimum of 30 minutes.

6.3.11.4 On the counter,

Set the FUNCTION switch to: MAN START
Set the TIME BASE switch to: 1 μs TIME UNIT/COUNT
Set the SENSITIVITY control to: CHECK

6.3.11.5 Verify proper counter operation.

6.3.11.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.

6.3.11.7 Plug in the Preset unit and set:

MODE switch to PRESET
N switches to 96000

6.3.11.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.

6.3.11.9 Start counting by depressing RESET switch on counter.

6.3.11.10 After approximately 30 seconds, read and record counter display.

6.3.11.11 Repeat steps 6.3.11.9 and 6.3.11.10 9 times.

6.3.11.12 The average of the 10 previous readings shall be 30.000000±0.000060 seconds.

6.3.11.13 Insure that the System is not in IMU Operate.

6.3.11.14 Perform the following DSKY operations.

VERB 21 NOUN 10 ENTR
00013 ENTR
02000 ENTR

Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is lighted.

6.3.11.15 Repeat steps 6.3.11.9 through 6.3.11.12.

6.3.11.16 Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is not lighted.

6.3.11.17 On the Computer Control and Reticle dimmer assembly, press and hold MARK X pushbutton.

6.3.11.18 On the DSKY observe

VERB 05 NOUN 31
Row 1 = 00112
Prog Alarm lamp is lighted
Press Error Reset

6.3.11.19 Enter the following on K-148

VERB 11	NOUN 10	ENTR
00016		ENTR

6.3.11.20 Observe that DSKY Row 1 displays 00004.

6.3.11.21 Release MARK X pushbutton

6.3.11.22 Observe that DSKY Row 1 displays 00000.

6.3.11.23 Press and hold the MARK Y pushbutton on the Computer Control and Reticle Dimmer Assembly.

6.3.11.23.1 On the DSKY Observe

VERB 05 NOUN 31
Row 1 = 00112
Program Alarm lamp is lighted
Press ERR Reset

6.3.11.23.2 Enter the following on K-148:

VERB 11	NOUN 10	ENTR
00016		ENTR

6.3.11.24 Observe that DSKY Row 1 displays 00010.

6.3.11.25 Release MARK Y pushbutton

6.3.11.26 Observe that DSKY Row 1 displays 00000.

6.3.11.27 Press and hold the REJECT pushbutton on the Computer Control and Reticle Dimmer Assembly.

6.3.11.28 Observe that DSKY Row 1 displays 00020.

6.3.11.29 Release the REJECT pushbutton.

6.3.11.30 Observe that DSKY Row 1 displays 00000.

6.3.11.31 On the DSKY perform the following operation

VERB 36 ENTR

6.3.11.32 On the Computer Control and Reticle dimmer assembly, rotate the RETICLE BRIGHTNESS control to its minimum light intensity position. View through the AOT and verify that the reticle lamp is off.

6.3.11.33 While viewing through the AOT, slowly rotate the RETICLE BRIGHTNESS control to increase the reticle brightness until a stop is reached. Observe that the reticle brightness has increased in intensity. Return RETICLE BRIGHTNESS control to off state.

6.3.11.34 AOT eyepiece Heater Test.

6.3.11.34.1 Secure milliameter HP 428B and current probe HP428A-21A.

6.3.11.34.2 Locate P1 at Computer Control and Reticle Dimmer assembly. Push lacing cord away from P1 back to fifth tie point.

6.3.11.34.3 Clip current probe HP428A-21A to blue wire in cable with red arrow pointing away from P1. Measure and record current indication. The current shall be between 139 and 244 ma.

6.3.11.34.4 Remove current probe, push lacing cord back to P1 and spot tie.

6.3.12 Gimbal Friction Test

6.3.12.1 Inner Gimbal Friction Test

6.3.12.1.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.12.1.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.1.3 Set up Analog Recorder to monitor the following signals:

	MEAS. NO.	SIGNAL NAME
a.	GG2110	IG Torque Motor Current
b.	GG2106	IG Servo Error Total
c.	GG2107	IG Servo Error In Phase
d.	GG2112	IG 1x Resolver Sine
e.	GG2113	IG 1x Resolver Cosine
f.	GG2220	IG CDU Fine Error
g.	GG1201	IMU 28V 1% 800 CPS
h.	GG2221	IG CDU Coarse Error

6.3.12.1.4 Set up Analog Recorder to monitor the following signals:

	MEAS. NO.	SIGNAL NAME
a.	GG2300	PIPA TEMP
b.	GG2301	IRIG TEMP
c.	GG1520	+28 VDC LGC OPR BUS

6.3.12.1.5 After 10 seconds has elapsed since step 6.3.12.1.1, enter the following into K-148.

VERB 21 NOUN 01 ENTR
00403 ENTR
00000 ENTR

6.3.12.1.6 Verify on CRT, DSKY display

VERB 21 NOUN 01
R1 = 00000
R3 = 00403

6.3.12.1.7 On K-148 enter the following sequence:

NOUN 15 ENTR
00000 ENTR ENTR (Push ENTR pushbutton twice)
Verify R1 = +00000
37777 ENTR ENTR
Verify R1 = 37777
37743 ENTR ENTR
Verify R1 = 37743

00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR (once)
Verify R1 = 00000

6.3.12.1.8 Start analog recorders using a chart speed of 10 mm/sec (IG - 360° TORQUE)

6.3.12.1.9 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTR
00370 ENTR
Record contents of CRT DSKY Row 1 xxxxY
VERB 21 NOUN 01 ENTR
00370 ENTR
XXXXY' ENTR
Where Y' is obtained from Table 1.
VERB 42 ENTR
VERB 33 ENTR

6.3.12.1.10 Monitor analog recorder. When the IG Torque Motor Current signal (GG2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.1.11 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.12.1.12 On the CRT, verify CDU X, CDU Y, CDU Z all indicate +00000 (±00200).

6.3.12.1.13 After 10 seconds has elapsed since step 6.3.12.1.11 enter the following sequence into K-148:

VERB 21 NOUN 01 ENTR
00403 ENTR
00000 ENTR

6.3.12.1.14 Verify on CRT, DSKY display

VERB 21 NOUN 01
R1 00000
R3 00403

6.3.12.1.15 On K-148 enter the following sequence:

NOUN 15 ENTR
00000 ENTR ENTR (Press ENTR pushbutton twice)
Verify R1 = 00000
40000 ENTR ENTR
Verify R1 = 400000
40034 ENTR ENTR
Verify R1 = 40034
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR (once)
Verify R1 = 00000

6.3.12.1.16 Start analog recorders using a chart speed of 10 mm/sec (IG +360° TORQUE)

6.3.12.1.17 On K-148 enter the following sequence

VERB 42 ENTR
VERB 33 ENTR

6.3.12.1.18 Monitor analog recorder. When the IG Torque Motor Current signal (GG2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.2 Outer Gimbal Friction Test

6.3.12.2.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.12.2.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.3 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2167	OG Servo Error In Phase
b. GG2170	OG Torque Motor Current
c. GG2166	OG Servo Error Total
d. GG2280	OG CDU Fine Error
e. GG2172	OG 1x Resolver Sine
f. GG2173	OG 1x Resolver Cosine
g. GG2281	OG CDU Coarse Error

6.3.12.2.4 After 10 seconds has elapsed since step 6.3.12.2.1 enter the following sequence into K-148:

VERB 21 NOUN 01 ENTR
00403 ENTR
37777 ENTR

6.3.12.2.5 Verify on CRT, DSKY display

VERB 21 NOUN 01
R1 37777
R3 00403

6.3.12.2.6 On K-148 enter the following sequence:

NOUN 15 ENTR
37743 ENTR ENTR (Press ENTR pushbutton twice)
Verify R1 = 37743
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR (once)
Verify R1 = 00000

6.3.12.2.7 Start analog recorders using a chart speed of 10 mm/sec. (OG - 360° TORQUE)

6.3.12.2.8 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.2.9 Monitor analog recorder. When the OG Torque Motor Current signal (GG2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.2.10 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+00000	ENTR		

6.3.12.2.11 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.12 After 10 seconds has elapsed since step 6.3.12.2.10, enter the following sequence into K-148.

VERB 21	NOUN 01	ENTR
00403	ENTR	
40000	ENTR	

6.3.12.2.13 Verify on CRT, DSKY display.

VERB 21	NOUN 01
R1	40000
R3	00403

6.3.12.2.14 On K-148 enter the following sequence:

NOUN 15	ENTR	
40034	ENTR	ENTR
Verify R1 =	40034	
00000	ENTR	ENTR
Verify R1 =	00000	
00000	ENTR	ENTR
Verify R1 =	00000	
00000	ENTR	ENTR
Verify R1 =	00000	
00000	ENTR	(once)
Verify R1 =	00000	

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6.3.12.2.15 Start analog recorders using a chart speed of 10 mm/sec (OG +360° TORQUE)

6.3.12.2.16 On K-148 enter the following sequence

VERB 42	ENTR
VERB 33	ENTR

6.3.12.2.17 Monitor analog recorder. When the OG Torque Motor Current signal (GG2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.3 Middle Gimbal Friction Test

6.3.12.3.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+06750	ENTR		

6.3.12.3.2 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = +06750±00200.

6.3.12.3.3 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2136	MG Servo Error Total
b. GG2137	MG Servo Error In Phase
c. GG2140	MG Torque Motor Current
d. GG2143	MG 1x Resolver Cosine
e. GG2250	MG CDU Fine Error
f. GG2142	MG 1x Resolver Sine
g. GG2251	MG CDU Coarse Error

6.3.12.3.4 After 10 seconds have elapsed since step 6.3.12.3.1, enter the following sequence into K-148:

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.3.5 Verify on CRT, DSKY display

VERB 21	NOUN 01
R1 =	00000
R3 =	00403

6.3.12.3.6 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR (Press ENTR pushbutton twice)
Verify R1 =	00000	
00000	ENTR	ENTR
Verify R1 =	00000	
00000	ENTR	ENTR
Verify R1 =	00000	
14000	ENTR	ENTR
Verify R1 =	14000	
00000	ENTR	(once)
Verify R1 =	00000	

6.3.12.3.7 Start analog recorders using a chart speed of 10 mm/sec. (MG - 135° TORQUE)

6.3.12.3.8 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.3.9 Monitor analog recorder. When MG Torque Motor Current (GG2140) drops to a quiescent level (approximately 6 minutes), stop the recorders.

6.3.12.3.10 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
-06750	ENTR		

6.3.12.3.11 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = -06750±00200.

6.3.12.3.12 After 10 seconds has elapsed since step 6.3.12.3.10, enter the following sequence into K-148:

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.3.13 On the CRT, DSKY display verify:

VERB 21	NOUN 01
R1 =	00000
R3 =	00403

6.3.12.3.14 On K-148 enter the following sequence:

NOUN 15	ENTR		
00000	ENTR	ENTR	(Press ENTR pushbutton twice)
Verify R1 =	00000		
00000	ENTR	ENTR	
Verify R1 =	00000		
00000	ENTR	ENTR	
Verify R1 =	00000		
63777	ENTR	ENTR	
Verify R1 =	63777		
77777	ENTR	(once)	
Verify R1 =	77777		

6.3.12.3.15 Start analog recorders using a chart speed of 10 mm/sec. (MG +135° TORQUE)

6.3.12.3.16 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.3.17 Monitor analog recorder. When the MG Torque Motor Current signal (GG2140) drops to a quiescent level (approximately 6 minutes) stop the recorders.

6.3.12.3.18 On K-148 enter the following sequence:

VERB 41	NOUN 20	ENTR
+00000	ENTR	
+00000	ENTR	
+00000	ENTR	

6.3.12.4 Test Analysis

6.3.12.4.1 Remove the strip charts from analog recorders

6.3.12.4.2 Examine each trace carefully to detect any sharp discontinuities of the traces. Disregard all transients less than 0.5 second (5 mm) on any Torque Motor Current signal. Disregard all transients less than 0.2 second (2 mm) on any CDU Fine Error signal.

6.3.12.4.3 No Torque Motor Current signal on (GG2140, GG2170, GG2110) shall ever exceed (0.125) amp. Sensitivity on recorder is 20 ma/division for GG2110, GG2140 and 36 ma/division for GG2170.

6.3.12.4.4 No CDU Fine Error on (GG2220, GG2280, GG2250) shall ever exceed (.070) volts. Sensitivity on recorder is 30 mv/division.

6.3.12.4.5 No CDU Coarse Error (GG2221, GG2281, GG2251) shall ever exceed 0.680 volts.

6.3.13 Stabilization Loop Step Response Test

6.3.13.1 IG Response Test

6.3.13.1.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+00000	ENTR		

6.3.13.1.2 On CRT, verify IG MG, and OG gimbal angles are between 358 and 002.

6.3.13.1.3 Set up analog recorder to monitor the following:

MEAS NO.	SIGNAL NAME
a. GG2110	IG Torque Motor Current
b. GG2106	IG Servo Error Total
c. GG2107	IG Servo Error In Phase
d. GG2112	IG 1X resolver Sine
e. GG2113	IG 1X Resolver Cosine
f. GG2220	IG CDU Fine Error
g. GG1201	IMU 28V 1 PCT 800 CPS

6.3.13.1.4 On K-148 initiate FINE ALIGN by entering the following sequence:

VERB 42	ENTR
+00000	ENTR
+00000	ENTR
+00000	ENTR

6.3.13.1.5 On the CRT verify CDU X, CDU Y and CDU Z indicate +00000±00200.

> CAUTION: If the transients caused by the subsequent step input do not damp out within 15 seconds, remove IMU Operate Power.

6.3.13.1.6 Enter 1000 into R-START 155.

6.3.13.1.7 Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the IG stabilization loop.

6.3.13.1.8 Prepare to start analog recorder at a chart speed of 100 mm/sec. (IG RESPONSE TEST)

6.3.13.1.9 Enter 0000 into R-START 155. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the IG stabilization loop.

6.3.13.1.10 After the transient on the recorder has died out, stop the recorder.

6.3.13.1.11 From the Servo Error In Phase signal recorder trace measure the time interval (T1, Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period T1, shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.

6.3.13.2 MG Response Test

6.3.13.2.1 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2136	MG Servo Error Total
b. GG2137	MG Servo Error in Phase
c. GG2140	MG Torque Motor Current
d. GG2143	MG 1X Resolver Cosine
e. GG2250	MG CDU Fine Error
f. GG2142	MG 1X Resolver Sine
g. GG1201	IMU 28V 1% 800 cps

6.3.13.2.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).

> CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU Operate power.

6.3.13.2.3 Enter 0100 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the MG stabilization loop.

6.3.13.2.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (MG RESPONSE TEST).

6.3.13.2.5 Enter 0000 into R-START 155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.

6.3.13.2.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.2.7 From the Servo Error In Phase signal recorder trace measure the time interval (T1 Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig 3). The period, T1, shall not exceed 0.1 seconds and the trace shall have no more than 3 overshoots.

6.3.13.3 OG Response Test

6.3.13.3.1 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2167	OG Servo Error In Phase
b. GG2170	OG Torque Motor Current
c. GG2166	OG Servo Error Total
d. GG2280	OG CDU Fine Error
e. GG2172	OG 1X Resolver Sine
f. GG2173	OG 1X Resolver Cosine
g. GG1201	IMU 28V 1% 800 cps

6.3.13.3.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).

CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU operate power.

6.3.13.3.3 Enter 0010 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the OG stabilization loop.

6.3.13.3.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (OG RESPONSE TEST).

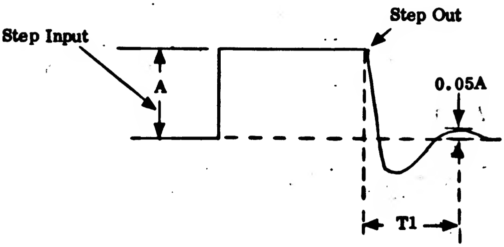
6.3.13.3.5 Enter 0000 into R-155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the OG stabilization loop.

6.3.13.3.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.3.7 From the Servo Error In Phase signal recorder trace, measure the time interval (T1, Fig 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig 3). The period, T1, shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.

6.3.13.3.8 On K-148 enter the following sequence:

VERB 41	NOUN 20	ENTR
+00000	ENTR	
+00000	ENTR	
+00000	ENTR	



TYPICAL STAB LOOP RESPONSE TO STEP INPUT

FIGURE 3

6.3.14 G&N Fine Alignment Test

6.3.14.1 On K-148 enter:

VERB 01 NOUN 10 ENTR
00003 ENTR

6.3.14.2 Record CRT, DSKY Row 1 display as AAAAA and the time of day.

6.3.14.3 On K-148 enter:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 02 ENTR
01300 ENTR

6.3.14.4 Record CRT DSKY Row 1 display as ±BBBBB

6.3.14.5 Perform the following calculations:

a. $\frac{\text{BBBBBX } 5.12}{3600} = \text{CCCC.C}$ Contents of high order scalar register in hours.

6.3.14.5.b Calculate the times of day at which the contents of the high order scalar will be at the following times.

2.91
5.82
8.73
11.64
14.55
17.46
20.37
23.30

6.3.14.6 If the time of day is within 12 minutes of any of those times calculated in 6.3.14.5.b when about to complete step 6.3.14.30 wait until that time has passed and then proceed.

6.3.14.7 On K-148 enter:

VERB 01 NOUN 01 ENTR
00370 ENTR
Record contents of DSKY Row 1 xxxxY
VERB 21 NOUN 01 ENTR
000370 ENTR
XXXXY' ENTR
Where Y' is obtained from Table 1a.
VERB 57 ENTR
00003 ENTR

6.3.14.8 Verify CRT DSKY display as:

VERB 06 NOUN 61 (Flashing)
R1 = +13500 (SM Azimuth)
R1 = +40.748 (Site Latitude)

NOTE: If R1 and R2 indications are correct proceed to step 6.3.14.10.

6.3.14.9 On K-148 enter:

VERB 21 ENTR
+13500 ENTR
VERB 22 ENTR
+40748 ENTR

6.3.14.10 On K-148 enter:

VERB 33 ENTR
Observe on CRT DSKY display
VERB 21 NOUN 30 (Flashing)

6.3.14.11 On K-148 enter:

0000X ENTR (Test position, either 1 or 2)
00000 ENTR (Use AOT)
Observe on CRT DSKY display:
VERB 06 NOUN 61 (Flashing)
Disregard Row 1, 2, and 3 indications

6.3.14.12 On K-148 enter:

VERB 21 ENTR
+XXX.XX ENTR (L tgt. true azimuth from 6.3.15.1.14)
VERB 22 ENTR
+XXX.XX ENTR (L tgt. elevation from 6.3.15.1.3)
VERB 23 ENTR
00001 ENTR (L tgt. number)
VERB 33 ENTR

Observe on CRT DSKY display:

VERB 06 NOUN 61 (Flashing)

Disregard Row 1, 2 and 3 indications.

6.3.14.13 On K-148 enter:

VERB 21 ENTR
+XXX.XX ENTR (F tgt. true azimuth from 6.3.15.1.14)
VERB 22 ENTR
+XXX.XX ENTR (F tgt. elevation from 6.3.15.1.12)
VERB 23 ENTR
00002 ENTR (F tgt. number)
VERB 33 ENTR

Observe on CRT DSKY display:
VERB 51 (flashing)
R1 = 00001

6.3.14.14 On Computer Control and Reticle Dimmer Assembly, press MARK X pushbutton. Observe on DSKY display:

VERB 21 NOUN 30 (Flashing)

6.3.14.15 On DSKY press ENTR

Observe on DSKY display:

VERB 21 NOUN 43 (Flashing)

6.3.14.16 On DSKY enter:

00001 ENTR (L Detent Code)
Observe on DSKY display
VERB 21 NOUN 42 (Flashing)

6.3.14.17 Set AOT to "L" position

6.3.14.18 Rotate AOT control knob until the center of the L tgt reticle is super imposed between the double Y reticle. Record AOT counter value as LY XXX.XX.

6.3.14.19 Rotate AOT control knob until the center of the L tgt reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as LS XXX.XX.

6.3.14.20 On DSKY enter:

±XXX.XX ENTR (value of LY)
Observe on DSKY display:
VERB 22 NOUN 42 (Flashing)

6.3.14.21 On DSKY enter:

±XXX.XX ENTR (Value of LS)
Observe on DSKY display:
VERB 51 (Flashing)
R1 = 00002

6.3.14.22 On Computer Control and Reticle Dimmer Assembly, press MARK X pushbutton. Observe on DSKY display:

VERB 21 NOUN 30 (Flashing)

6.3.14.23 On DSKY press ENTR. Observe on DSKY display:

VERB 21 NOUN 43 (Flashing)

6.3.14.24 On DSKY enter:

00002 ENTR (F Detent Code)
Observe on DSKY display:
VERB 21 NOUN 42 (Flashing)

6.3.14.25 Set AOT to "F" position

6.3.14.26 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double Y reticle. Record AOT counter value as FY XXX.XX.

6.3.14.27 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as FS XXX.XX.

6.3.14.28 On DSKY enter:

±XXX.XX ENTR (value of FY)
Observe on DSKY display:
VERB 22 NOUN 42 (Flashing)

6.3.14.29 On DSKY enter:

±XXX.XX ENTR (value of FS)

NOTE: Wait until DSKY display indicates VERB 51 (Flashing) R1 = 00001 before proceeding.

NOTE: Before completing step 6.3.14.30 check time of day to verify that the high order scalar will not overflow within the next 12 minutes.

6.3.14.30 Repeat steps 6.3.14.14 through 6.3.14.29.

6.3.14.31 In approximately 7 minutes, observe on CRT DSKY display and record.

VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Where number part of Y_{sm} misalignment about Z_{sm})
R2 = .XXXXX (Fractional number part of Y_{sm} misalignment about Z_{sm}.)

6.3.14.32 On K-148 enter.

VERB 33 ENTR
Observe on CRT DSKY display and record:
VERB 06 NOUN 66 (Flashing)

R1 = XXXXX (Whole number part of Z_{sm} misalignment about Y_{sm})
R2 = .XXXXX (Fractional number part of Z_{sm} misalignment about Y_{sm})

6.3.14.33 On K-148 enter:

VERB 36 ENTR
Press ERROR RESET

6.3.14.34 Repeat steps 6.3.14.7 through 6.3.14.30.

6.3.14.35 In approximately 7 minutes, observe on CRT DSKY display and record:

VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Whole number part of X_{sm} misalignment about Y_{sm})
R2 = .XXXXX (Fractional number part of X_{sm} misalignment about Y_{sm})

6.3.14.36 On K-148 enter:

VERB 33 ENTR
Observe on CRT DSKY display and record:
VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Whole number part of Y_{sm} misalignment about X_{sm})
R2 = .XXXXX (Fractional number part of Y_{sm} misalignment about X_{sm})

6.3.14.37 On K-148 enter:

VERB 36 ENTR
Press ERROR RESET
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.14.38 Results. The PIPA bias determined previously in the IMU Performance Test (6.3.9) must be subtracted from the resultant data of the test.

6.3.14.38.1 Y PIPA misalignment

R1 R2
About Z axis (from 6.3.14.31) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Y PIPA bias (from 6.3.9) = - (±XXXXX. XXXXX) $\widehat{\text{sec}}$
Y PIPA misalignment about Z axis = ------.------ $\widehat{\text{sec}}$
This value shall not exceed ±600 $\widehat{\text{sec}}$

6.3.14.38.2 Z PIPA misalignment

R1 R2
About Y axis (from 6.3.14.32) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Z PIPA bias (from 6.3.9) = - (±XXXXX. XXXXX) $\widehat{\text{sec}}$
Z PIPA misalignment about Y axis = ± ------.------ $\widehat{\text{sec}}$
This value shall not exceed ±600 $\widehat{\text{sec}}$

6.3.14.38.3 Z PIPA misalignment

R1 R2
About Y axis (from 6.3.14.35) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less X PIPA bias from (6.3.9) = -(±XXXXX. XXXXX) $\widehat{\text{sec}}$
X PIPA misalignment about Y axis = ±------.------ $\widehat{\text{sec}}$
This value shall not exceed ±600 $\widehat{\text{sec}}$

6.3.14.38.4 Y PIPA misalignment

R1 R2
About X axis from (6.3.14.36) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Y PIPA bias (from 6.3.9) = -(±XXXXX. XXXXX) $\widehat{\text{sec}}$
Y PIPA misalignment about X axis = ±------.------ $\widehat{\text{sec}}$
This value shall not excee ±600 $\widehat{\text{sec}}$

6.3.15 AOT Functional Accuracy Test

NOTE: Use of a Dioptometer is required when sighting through AOT.

6.3.15.1 Determination of Detent Angle Reference.

NOTE: The included angles between targets LOS shall be known to ±10 arc seconds. The elevation of each target LOS shall be known to ±15 arc seconds.

6.3.15.1.1 Place AOT in L detent position.

NOTE: Communication between AOT and target theodolite operators is required.

6.3.15.1.2 While viewing through AOT, instruct the target L operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target L, until the target reticle appears in the lower right quadrant of the AOT field of view.

NOTE: The target theodolite base must be level when alignment is achieved.

6.3.15.1.3 Upon alignment, zero the azimuth dial and record the elevation indication of target L as ϕ_1.

6.3.15.1.4 Place AOT in R detent position.

6.3.15.1.5 While viewing through AOT, instruct the target R operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target R, until the target reticle appears in the lower left quadrant of the AOT field of view.

6.3.15.1.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record the target R elevation dial indication as ϕ_3. Zero the target R azimuth dial. Record AOT dial indication as RY = XXX.XX.

6.3.15.1.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT dial indication as RS = XXX.XX.

6.3.15.1.8 Collimate L and R targets on each other, record each target azimuth with each target LOS leveled.

Target L az = α_1, Target R as = α_3

6.3.15.1.9 Place the AOT in F detent position.

6.3.15.1.10 Move the R target theodolite to a position in front of the AOT F detent position. (The target shall now be referred to as the F target).

6.3.15.1.11 While viewing through the AOT, instruct the target F operator to translate (vertically and laterally) and rotate(in azimuth and elevation) target F until the center of the target reticle appears in the center of the AOT reticle.

6.3.15.1.12 Upon alignment, zero the azimuth dial and record the elevation indication of target F as ϕ_2.

6.3.15.1.13 Collimate L and F targets on each other, record each target azimuth with each target LOS leveled.

Target F az = α_2, Target Laz = α_1'

6.3.15.1.14 Determine the true azimuth of targets L and F with respect to the AOT. The target azimuth shall be known to within 0.5 arc degrees.

6.3.15.1.15 Rotate the F target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.12.

6.3.15.1.16 Rotate the L target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.13.

6.3.15.1.17 Calculate the values of the included angles between target L and F as X_1 and targets L and R as X_2.

$$X_1 = \cos^{-1}\left\{\sin \phi_1 \sin \phi_2 + \cos \phi_1 \cos \phi_2 \cos\left[180 - (\alpha_1 + \alpha_2)\right]\right\}$$
$$X_2 = \cos^{-1}\left\{\sin \phi_1 \sin \phi_3 + \cos \phi_1 \cos \phi_3 \cos\left[180 - (\alpha_3 + \alpha_1)\right]\right\}$$

Where: α_1 = az value, step 6.3.15.1.8
α_2 = az value, step 6.3.15.1.13
α_3 = az value, step 6.3.15.1.8
α_1 = az value, step 6.3.15.1.13.

6.3.15.2 Computer Loading of Detent Calibration Data

6.3.15.2.1 On K-148 enter:

VERB 21	NOUN 03	ENTR
01462		ENTR
XXX.XX		ENTR (Detent L az data)
		ENTR
01463		ENTR
XXX.XX		ENTR (Detent F az data)
		ENTR
01464		ENTR
XXX.XX		ENTR (Detent R az data)
		ENTR
01465		ENTR
XXX.XX		ENTR (Detent L EL data)
		ENTR
01466		ENTR
XXX.XX		ENTR (Detent F EL data)
		ENTR
01467		ENTR
XXX.XX		ENTR (Detent R EL data)
		ENTR

6.3.15.3 AOT Measurement of X_1

6.3.15.3.1 On K-148 enter:

VERB 57 ENTR
00012 ENTR
Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display.

6.3.15.3.2 On Computer Control and Reticle Dimming Assembly press MARK X pushbutton. Observe VERB 50 displayed on CRT DSKY display.

6.3.15.3.3 On DSKY press ENTR
Observe VERB 21 NOUN 30 flashing on DSKY

6.3.15.3.4 On DSKY enter:

00000 ENTR
Observe VERB 21 NOUN 43 flashing
00001 ENTR
Observe VERB 21 NOUN 42 flashing

6.3.15.3.5 Set AOT in L detent position.

6.3.15.3.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record as LY = XXX. XX.

6.3.15.3.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT dial indication as LS XXX. XX.

6.3.15.3.8 On DSKY enter:

±XXX. XX ENTR (LY from 6.3.15.3.6)
Observe VERB 22 NOUN 42 flashing
±XXX. XX ENTR (LS from 6.3.15.3.7)
Observe VERB 51 flashing and R1 = 00002.

6.3.15.3.9 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed.

6.3.15.3.10 On DSKY press ENTR
Observe VERB 21, NOUN 30 flashing on DSKY.

6.3.15.3.11 On DSKY enter:

00000 ENTR
Observe VERB 21, NOUN 43 flashing
00002 ENTR
Observe VERB 21, NOUN 42 flashing

6.3.15.3.12 Set AOT in F detent position.

6.3.15.3.13 Rotate AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Record AOT dial indication as FY = XXX.XX.

6.3.15.3.14 Rotate the AOT control knob until the center of the target reticle is superimposed between the double S reticle lines. Record AOT dial indication as FS = XXX.XX.

6.3.15.3.15 On DSKY enter:

±XXX.XX ENTR (FY from 6.3.15.3.13)
Observe VERB 22 NOUN 42 flashing
±XXX.XX ENTR (FS from 6.3.15.3.14)
Observe VERB 06 NOUN 03, R1 = X1±0.08 degrees.

6.3.15.4 AOT Measurement of X2

6.3.15.4.1 On K-148 enter

VERB 57 ENTR
00012 ENTR
Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display

6.3.15.4.2 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed on CRT DSKY display.

6.3.15.4.3 On DSKY press ENTR. Observe VERB 21 NOUN 30 flashing on DSKY.

6.3.15.4.4 On DSKY enter:

00000 ENTR
Observe VERB 21 NOUN 43 flashing
00001 ENTR
Observe VERB 21 NOUN 42 flashing
±XXX.XX ENTR (LY from 6.3.15.3.6)
Observe VERB 22 NOUN 42 flashing
±XXX.XX ENTR (LS from 6.3.15.3.7)
Observe VERB 51 flashing and R1 = 00002.

6.3.15.4.5 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed.

6.3.15.4.6 On DSKY press ENTR. Observe VERB 21, NOUN 30 flashing on DSKY.

6.3.15.4.7 On DSKY enter:

00000 ENTR
Observe VERB 21 NOUN 43 flashing
00002 ENTR
Observe VERB 21 NOUN 42 flashing
±XXX.XX ENTR (RY from 6.3.15.1.6)
Observe VERB 22 NOUN 42 flashing
±XXX.XX ENTR (RS from 6.3.15.1.7)
Observe VERB 06 NOUN 03, R1 = X2±0.08 degrees.

APPENDIX I

MEASUREMENT TOLERANCES

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY 1% OF FULL SCALE
GG 1020 link 4*	+14 vdc LGC Supply	14.0±0.4 vdc	0%
GG 1030 link 4	+4 vdc LGC Supply	4.0±0.2 vdc	0%
GG 1040 link 5**	+120 vdc PIPA Supply	120±6.0 vdc	1%
GG 1070 link 4	+4 vdc CDU Supply	4.0±0.2 vdc	0%
GG 1100 link 4	-28 vdc Supply	-27.5±6.0 vdc	0%
GG 1110 link 5	2.5 vdc Telemetry Bias No. 1	2.5±0.1 vdc	0%
GG 1201 link 5	IMU 28V 800 cps 1%	28±0.56V rms	1%
GG 1202 link 4	IMU 28V 800 cps 5%	28±1.4V rms	1.5%
GG 1203 link 4	IMU 28V 800 cps 5%	28±2.1V rms	1.5%
GG 1331 link 5	3.2 kc 28V Supply 1%	28.6±0.56V rms	1%
GG 1500 link 4	+28 vdc IMU Oper BUS	28.0 -3.5, +5.5 vdc	0%
GG 1510 link 4	+28 vdc IMU STBY BUS	28.0 -3.5, +5.5 vdc	0%
GG 1513X link 5	+28 vdc IMU STBY/OFF	28.0±1 vdc	0%
GG 1520 link 4	+28 vdc LGC Oper BUS	28.0 +4.5, -3.5 vdc	0%
GG 1523X link 5	+28 vdc LGC Operate	28.0±1 vdc	0%
GG 2001 link 5	X PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2021 link 5	Y PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2041 link 5	Z PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2106 link 4	IG Servo Error Total	0.0±60 MV rms at null	1%
GG 2107 link 5	IG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2110 link 4	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2110 link 5	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2112 link 5	IG 1X Resolver Out-Sine	18.4±1.84V rms at 45°	2.5%
GG 2113 link 5	IG 1X Resolver Out-Cosine	18.4±1.84V rms at 45°	2.5%
GG 2121 link 5	IG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2136 link 4	MG Servo Error Total	0.0±60 MV rms at null	1%
GG 2137 link 5	MG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2140 link 4	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2140 link 5	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2142 link 5	MG 1X Resolver Out-Sine	18.4±1.84V rms at 45°	2.5%
GG 2143 link 5	MG 1X Resolver Out-Cosine	18.4±1.84V rms at 45°	2.5%
GG 2151 link 5	MG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2166 link 4	OG Servo Error Total	0.0±60 MV rms at null	1%
GG 2167 link 5	OG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2170 link 4	OG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
NG 1336 link 4	PH DIFF 3.2kc 28V/LGC SYNC	0° ±10°	3%

APPENDIX I (Continued)

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY % OF FULL SCALE
GG 2170 link 5	OG Torque Motor Current	0.9 AMP Max during any fine Align Torque	1%
GG 2172 link 5	OG 1X Resolver Out-Sine	18.4±1.84V rms at 45°	2.5%
GG 2173 link 5	OG 1X Resolver Out-Cosine	18.4±1.84V rms at 45°	2.5%
GG 2181 link 5	OG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2219 link 5	Pitch Attitude Error	5.05±0.5V rms at 17°	1%
GG 2220 link 4	IG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2221 link 4	IG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2249 link 5	YAW Attitude Error	5.05±0.5V rms at 17°	1%
GG 2250 link 4	MG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2251 link 4	MG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2279 link 5	Roll Attitude Error	5.05±0.5V rms at 17°	1%
GG 2280 link 4	OG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2281 link 4	OG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2300 link 5	PIPA Temperature	130.5±1.5°F in Operate	1%
GG 2301 link 4	IRIG Temperature	135±2.5°F in Operate	1%
GG 2301 link 5	IRIG Temperature	135±2.5°F in Operate	1%
GG 2302 link 4	IMU Heater Current On	28±1 vdc	0%
GG 2303 link 4	IMU Blower Current On	28±1 vdc	0%
GG 3304 link 5	RR Shaft 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3305 link 5	RR Shaft 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 3311 link 4	RR Shaft CDU Fine Error	0.0±0.07V rms at null	1%
GG 3312 link 4	RR Shaft CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3321 link 4	RR Trunnion CDU Fine Error	0.0±0.07V rms at null	1%
GG 3322 link 4	RR Trunnion CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3324 link 5	RR Trunnion 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3325 link 5	RR Trunnion 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 4300 link 4	LGC Temperature	87.5±42.5°F	0%
GG 6020 link 4	PIPA Calibration Module Temperature	67.5±22.5°F	0%
GG 6020 link 5	PIPA Calibration Module Temperature	67.5±22.5°F	0%
GG 6021 link 4	PSA Temperature	85±25.0°F	0%

~~* Link 4 — PSAAM Output Panel~~

~~** Link 5 — SCA [illegible]~~

3

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY OF FULL SCALE
NG1021 link 4	14 VDC LGC Noise RMS	0.4 VRMS Max	0%
NG1022 link 4	14 VDC LGC Noise Peak	5 volts with rise time of 2 to 5 usec	0%
NG1031 link 4	4 VDC LGC Noise RMS	0.4 VRMS Max	0%
NG1032 link 4	4 VDC LGC Noise Peak	5 volts with rise time of 2 to 50 used	0%
NG1071 link 4	4 VDC CDU Noise RMS	1.0 VRMS Max	0%
NG1072 link 4	4 VDC CDU Noise Peak	5 volts with rise time of 2 to 50 usec	0%
NG1501 link 4	28 VDC IMU Operate Noise RMS	1.0 VRMS Max	0%
NG1502 link 4	28 VDC IMU Operate Noise Peak	5 volts with rise time of 2 to 50 usec	0%
NG1511 link 4	28 VDC IMU Standby Noise RMS	1.0 VRMS Max	0%
NG1512 link 4	28 VDC IMU Standby Noise Peak	5 volts with rise time of 2 to 50 usec	0%
NG1521 link 4	28 VDC LGC Operate Noise RMS	2.0 VRMS Max	0%
NG1522 link 4	28 VDC LGC Operate Noise Peak	5 volts with rise time of 2 to 50 usec	0%

*Link 4 - PSAAM Output Signal
**Link 5 - SCA Output Signal

ADDENDUM 1

LEM 1

ADDITION 1: The following procedure will be performed for LEM 1 only.

6.3.16 Gyrocompassing Test

6.3.16.1 Insure that the IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.16.2 On K-148 enter the following sequence:

VERB 57 ENTR
00006 ENTR

6.3.16.3 VERB 06 NOUN 61 shall flash.

6.3.16.4 The CRT, DSKY display shall display Launch Azimuth. (Launch Azimuth shall be the GAEC Navigator Base Azimuth defined by GAEC).

6.3.16.5 If value for Row 1 is correct, proceed to the next step. If value for Row 1 is incorrect, enter the following into K-148:

VERB 21 ENTR
±XXXXX ENTR Correct launch azimuth (GAEC Nav Base Az)

Verify value in Row 1 is correct.

6.3.16.6 On K-148 enter the following:

VERB 33 ENTR

6.3.16.7 VERB 06 NOUN 61 shall flash.

6.3.16.8 The CRT, DSKY display shall display Navigation Base Azimuth and Latitude, respectively.

6.3.16.9 If the values for Row 1 and Row 2 are correct, proceed to the next step. If the values for Row 1 or Row 2 are incorrect, enter the following into K-148.

If Row 1 is incorrect: VERB 21 ENTR
±XXXXX ENTR (Correct Nav Base Azimuth)

If Row 2 is incorrect: VERB 22 ENTR
+40.748 ENTR (Correct Site Latitude)

Verify values for Row 1 and Row 2 are correct.

6.3.16.10 On K-148 enter the following:

VERB 33 ENTR
VERB 16 NOUN 20 ENTR

6.3.16.11 One hour after step 6.3.16.10 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.16.12 Obtain and record the latest measured value of the following data.

6.3.16.12.1 NBDX

6.3.16.12.2 NBDY

6.3.16.12.3 NBDZ

6.3.16.12.4 ADIAZ

6.3.16.12.5 ADSRAY

6.3.16.12.6 GAEC NB YZ plane about Z local vertical.

6.3.16.12.7 GAEC NB YZ plane about Y local vertical.

6.3.16.13 Calculate the vertical and east IRIG coefficient drift contribution to azimuth error (ϕ Vert).

a. Drift (vert) = NBDZ+ADIAZ = ________________ meru

b. Drift (east) = NBDX sin α +NBDY sin (α + 90) + ADSRAY sin (α + 90)
Where α = Launch Azimuth

c. $\phi \text{ vert} = \frac{6.65a + 272b}{3600} =$ ____________ degrees

6.3.16.14 Algebraically add ϕ (vert) from the Row 1 DSKY display recorded in 6.3.16.11. The resultant azimuth error shall be 000.00±000.57 degrees.

6.3.16.15 Algebraically subtract the value recorded in 6.3.16.12.6 from the Row 3 DSKY display recorded in 6.3.16.11. The resultant vertical error about Z local vertical shall be 000.00±000.06 degrees.

6.3.16.16 Algebraically subtract the value recorded in 6.3.16.12.7 from the Row 2 DSKY display recorded in 6.3.16.11. The resultant vertical error about Y local vertical shall be 000.00±000.06 degrees.

6.3.16.17 Two hours after 6.3.16.10 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.16.18 The CRT DSKY display of Row 1 shall be within 000.06 degrees of the value recorded in 6.3.16.11. The CRT DSKY display of Row 2 and Row 3 shall be within 000.03 degrees of the respective values recorded in 6.3.16.11.

6.3.16.19 On K-148 enter the following:

VERB 36		ENTR
VERB 40	NOUN 20	ENTR
+00000		ENTR
+00000		ENTR
+00000		ENTR

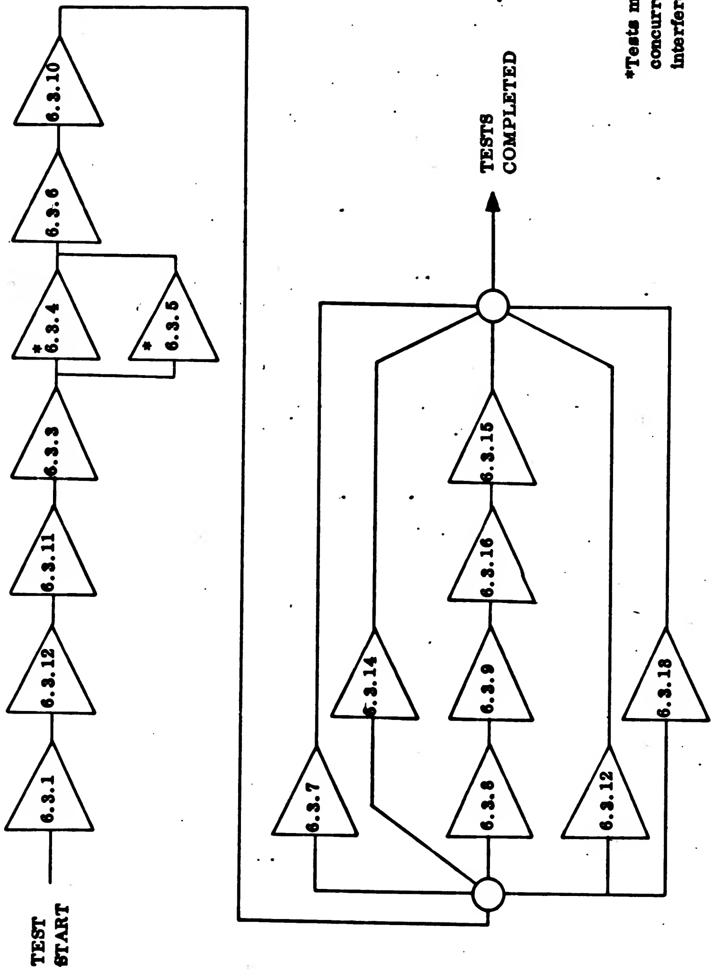
ADDENDUM 1

LEM 1

Addition 2: Perform LEM 1 test in accordance with the following Flowgram.

Addition 3: Place a note after paragraph 6.3.1.6.2.

NOTE: If the LMP Interlock CB is energized insure that the ATCA switch on LEM Panel 16 and the ATCA/PGNCS switch on Panel 11 are in the off position before performing the following steps.



*Tests may be performed concurrently on a non-interference basis

TEST PROCEDURE FLOWGRAM

FIGURE 1

ADDENDUM II
AURORA 85

Following are the changes required to make this document applicable for checkout of a G&N System with an Aurora 85 Test Rope.

Addition 1. Paragraph 6.3.7 PGNCS Operational Test

a. Delete paragraphs 6.3.7.15.2 and 6.3.7.15.3

b. Subtract an Octal 1 from each of the NOUN display requirements in paragraphs 6.3.7.20.1, 6.3.7.20.3, 6.3.7.20.5, 6.3.7.20.7, 6.3.7.20.9, 6.3.7.20.11 and 6.3.7.20.13.

Addition 2. Paragraph 6.3.8 IRIG Scale Factor Test

a. Change Paragraph 6.3.8.22 to read as follows:

The average of the three readings of Scale Factor Error for each of the 6 positions shall be 556±1750 PPM.

Addition 3. Paragraph 6.3.9 IMU Performance Test.

a. Add the following note prior to step 6.3.9.22.

NOTE: Paragraph 6.3.9.24 must be performed within one minute after VERB 06 and NOUN 66 flash in paragraph 6.3.9.23. In the event a PROG alarm is obtained enter VERB 36, press the ENTR pushbutton and repeat paragraphs 6.3.9.8 through 6.3.9.24.

b. Add the following note prior to step 6.3.9.36.

NOTE: Paragraph 6.3.9.39 must be performed within one minute after VERB 06 and NOUN 66 flash in paragraph 6.3.9.38. In the event a PROG alarm is obtained enter VERB 36, press ENTR and repeat paragraphs 6.3.9.8 through 6.3.9.1. Enter the following in K-148.

VERB 25	ENTR
+00600	ENTR
+00000	ENTR
+00003	ENTR

Repeat paragraphs 6.3.9.28 through 6.3.9.39.

6.3.17.4.4 On K-148 enter the following:

Press ERR RST
VERB 36 ENTR
VERB 41 NOUN 40 ENTR
+00000 ENTR
+03375 ENTR
VERB 34 ENTR
VERB 21 NOUN 10 ENTR
00012 ENTR
00001 ENTR

Verify RR CDU Fail comes ON in approximately 90 seconds.

ADDENDUM III RR INTERFACE

LTA-8, (MSC) - LEM 2 & Subsequent

RR CDU testing requires that the Rendezvous Radar is operating. The Rendezvous Radar is not activated until Integrated testing. To insure that the RR CDU's are operating properly the minimum requirements for RR CDU testing are presented here so that they may be included as part of the requirements to be demonstrated at the first opportunity after Rendezvous Radar activation.

6.3.17 RR/CDU Control

6.3.17.1 Command Accuracy 24000°

6.3.17.1.1 On K-148 enter the following

VERB 36 ENTR
VERB 41 NOUN 40 ENTR
+24000 ENTR
+24000 ENTR
VERB 34 ENTR

The CRT RR CDU Trunnion and Shaft angle indications shall be 240.00±000.30°.

6.3.17.2 CDU Fine and CDU Coarse Error

6.3.17.2.1 Set up analog recorder to monitor the following:

Meas. No.	Signal Name
a. GG3311	Shaft CDU Fine Error
b. GG3312	Shaft CDU Coarse Error
c. GG3321	Trunnion CDU Fine Error
d. GG3322	Trunnion CDU Coarse Error

6.3.17.2.2 On K-148 enter the following:

VERB 36 ENTR
VERB 41 NOUN 40 ENTR
+04500 ENTR
+04500 ENTR
VERB 34 ENTR

6.3.17.2.3 Verify the following signals on the CRT.

RR Shaft 1X Sin (GG3304)	18.4±1.84 VRMS
RR Shaft 1X Cos (GG3305)	18.4±1.84 VRMS
RR Trunnion 1X Sine (GG3324)	18.4±1.84 VRMS
RR Trunnion 1X Cos (GG3325)	18.4±1.84 VRMS

6.3.17.2.4 Verify that no CDU Fine Error (GG3311, GG3321) exceeds .070 volts.

6.3.17.2.5 Verify that no CDU Coarse Error (GG3312, GG3322) exceeds .680 volts.

6.3.17.3 CDU Repeatability

6.3.17.3.1 Record the CRT RR Shaft and Trunnion CDU indications.

6.3.17.3.2 On K-148 enter the following:

VERB 40 NOUN 40 ENTR

Wait 10 seconds then record the CRT RR CDU Trunnion and Shaft indications; the recorded value shall be within ±000.01° of the value recorded above.

6.3.17.4 RR CDU Fail

6.3.17.4.1 On K-148 Enter the following:

VERB 36 ENTR
VERB 41 NOUN 40 ENTR
00100 ENTR
00000 ENTR
VERB 34 ENTR
VERB 21 NOUN 10 ENTR
00012 ENTR
00001 ENTR

Verify RR CDU Fail comes ON is approximately 90 seconds.

6.3.17.4.2 On K-148 enter the following:

Press ERR RST
VERB 36 ENTR
VERB 41 NOUN 40 ENTR
+00000 ENTR
+00100 ENTR
VERB 34 ENTR
VERB 21 NOUN 10 ENTR
00012 ENTR
00001 ENTR

Verify RR CDU Fail comes ON in approximately 90 seconds.

6.3.17.4.3 On K-148 enter the following:

Press ERR RST

VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+03375		ENTR
+00000		ENTR
VERB 34		ENTR
VERB 21	NOUN 10	ENTR
00012		ENTR
00001		ENTR

Verify RR CDU Fail comes ON in approximately 90 seconds.

APOLLO G&N Specification
ND 1002323 REV F

Original Issue Date:
Release Authority: TDRR 31026
Class A Release

POST-INSTALLATION CHECKOUT SPECIFICATION
FOR LM G&N SYSTEM

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	APPROVALS	
				AC	NASA
11/22/66	A	32056	1-83 Was 83 pages, now 80 pages.	EA	WLS
12/29/66	B	32480	6-46, 51, 62, 67, 73, 74, 78	JP	- -
2/27/67	C	33084	5-86	EA	--
4/17/67	D	33613	3, 6, 7, 16, 17, 18, 22, 23, 28, 35,		
			44, 45, 64, 79, 85	EA	WLS
7/27/67	E	34218	3, 5-7, 9-12, 14, 16-86; was 86 pages	EA	--
			now 94 pages.		
11/2/67	F	35010	6-94; was 94 pages, now 95 pages.	EA	--

This specification consists of page 1 to 95 inclusive.

APPROVALS	NASA/MSC				ACED 9/13/66

5.2.2 The PSA, CDU, and PTA cold plates shall be provided with coolant as per ICD LIS-510-10001.

5.3 TEST EQUIPMENT TOLERANCES

5.3.1 Measurement and tolerance specifications stated herein are basic G&N system performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. Final tolerances must include PSAAM and SCA stability uncertainties. All uncertainties due to instrumentation shall be root sum squared with the basic G&N tolerances to yield an acceptable tolerance for use when testing the G&N system in the spacecraft.

5.3.2 In the event of a conflict between requirements, the following order of precedence shall apply. The contractor shall also notify AC Electronics Site Manager of the conflict.

a. The contract
b. This specification
c. Documents referenced in this specification

5.4 TEST SEQUENCE

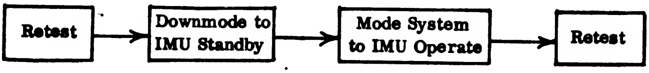
5.4.1 The test sequence shall normally follow the flowgram in Figure 2. Any test subsequent to Temperature Control Verification Section 6.3.4 may be conducted providing the General Turn On Procedure 6.2.4 is followed.

5.5 The generation of a noise alarm indication, as evidenced by one or more Noise Peak Event lamps becoming lighted shall be cause for immediate determination of effects on the G&N system test in progress. In the event of detrimental effects on the system test a troubleshooting routine shall be entered to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.

5.6 TEST FAILURE CRITERIA

5.6.1 IRIG and PIPA data (See paragraph 6.3.9)

5.6.1.1 If D_1, D_2, or D_3 exceeds its maximum value as specified in 6.3.9 for any IRIG or PIPA, a retest sequence shall be initiated as indicated below:



RETEST SEQUENCE

The retest sequence shall be performed using the paragraphs indicated in Table 4 corresponding to the out-of-spec parameters. Table 5 indicates the test positions and other isolated parameters that must be recalculated and qualified.

If D_1, D_2, and D_3 are within tolerance after the retest sequence is completed, the original out-of-tolerance terms calculated in 6.3.9.70.4 shall be exonerated.

PARAGRAPH NUMBERS

5.3.9.X where X is listed below

O.O.S. PARAMETERS	5.3.9 → 5.3.9.11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
NBDX	X																X	X	X											
NBDY	X	X	X	X																										
NBDZ	X								X	X	X																			
ADSRAX	X																X	X	X											
ADSRAY	X	X	X	X																		X	X	X	X					
ADSRAZ	X								X	X	X																			
ADIAX	X	X	X	X				X	B	X	C	X	X	X	X	X	X	X	X											
ADIAY	X	X	X	X				X	B	X	C	X	X	X	X	X	X	X	X											
ADIAZ	X								X	X	A					X	X	X	X			X	X	X	X	X	X	X	X	X
X PIPA BIAS & S.F. ERROR	X	B	X	C	X	X	X	X	B	X	C	X	X																	
Y PIPA BIAS & S.F. ERROR	X																													
Z PIPA BIAS & S.F. ERROR	X																B	X	C	X	X	X	B	X	C	X	X	X		

O.O.S. PARAMETERS	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	64	65	67	68	69
NBDX																											X		X
NBDY																											X		X
NBDZ																											X		X
ADSRAX											X	X	X	X													X		X
ADSRAY																											X		X
ADSRAZ																			X	X	X	X					X		X
ADIAX																											X		X
ADIAY											X	X	X	X													X		X
ADIAZ																							X	X	X	X	X		X
X PIPA BIAS & S.F. ERROR																											X		X
Y PIPA BIAS & S.F. ERROR		X	X	X	X	X	X	X	X	X	X	X	X														A		X
Z PIPA BIAS & S.F. ERROR																											X		X

TABLE 4

A - Wait until GIMBAL LOCK lamp goes out before performing this step.

B - On K-148 enter the following

V25	ENTR
+00001	ENTR
+00000	ENTR
+0000X	ENTR Where X is test position number represented in DSKY Row 3 display

C - When VERB 06 NOUN 66 flashes do not record test results.

PARAGRAPH NUMBERS

G.&N. PARAMETERS	6.3.9 → 6.3.9.11	6.3.9.X where X is listed below																																																						
		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69
NBDX	X																X	X	X																																						X		X
NBDY	X	X	X	X																																																					X		X
NBDZ	X								X	X	X																																														X		X
ADSRAX	X																X	X	X																						X	X	X	X													X		X
ADSRAY	X	X	X	X																		X	X	X	X																																X		X
ADSRAZ	X								X	X	X																																						X	X	X	X					X		X
ADIAX	X	X	X	X				X	B	X	C	X	X	X	X	X	X	X	X																																						X		X
ADIAY	X	X	X	X				X	B	X	C	X	X	X	X	X	X	X	X																						X	X	X	X									X	X	X	X	X		X
ADIAZ	X								X	X	A					X	X	X	X			X	X	X	X	X	X	X	X	X																											X		X
X PIPA BIAS & S.F. ERROR	X	B	X	C	X	X	X	X	B	X	C	X	X																																												X		X
Y PIPA BIAS & S.F. ERROR	X																															X	X	X	X	X	X	X	X	X	X	X	X														A		X
Z PIPA BIAS & S.F. ERROR	X																B	X	C	X	X	X	B	X	C	X	X	X																												X		X

TABLE 4

A - Wait until GIMBAL LOCK lamp goes out before performing this step.

B - On K-148 enter the following

V25 ENTR
+00001 ENTR
+00000 ENTR
+0000X ENTR Where X is test position number represented in DSKY Rev 3 display

C - When VERB 06 NOUN 66 flashes do not record test results.

TABLE 5

O.O.S. PARAMETER	PERFORM POSITIONS	PARAMETERS TO BE REQUALIFIED
NBDY	1	NBDY
NBDZ	2	NBDZ
NBDX	3	NBDX
ADSRAY	1 and 4	ADSRAY, NBDY
ADSRAZ	2 and 9	ADSRAZ, NBDZ
ADSRAX	3 and 7	ADSRAX, NBDX
ADIAY	1 thru 3, 7 and 10	NBDY, NBDX, ADIAX, ADSRAX, ADIAY
ADIAZ	2 thru 4	NBDZ, NBDX, ADIAZ
ADIAX	1 thru 3	NBDX, ADIAX, NBDY
X PIPA Bias or S.F.	1 thru 2	X PIPA BIAS, X PIPA S.F.
Y PIPA Bias or S.F.	5 and 6	Y PIPA BIAS, Y PIPA S.F.
Z PIPA Bias or S.F.	3 and 4	Z PIPA Bias, Z PIPA S.F.

TABLE A

RETEST SEQUENCE

Paragraph Number	Test Title	LGC	IMU	PSA	CDU	PTA	DSKY	A Harness	B Harness	Computer Control and Reticle Dimmer	Nav Base	Alignment Optical Telescope	Signal Conditioner
6.3.1	Standby Power On Test	X	X	X			X	X	X		X		
6.3.2	Alarms and Interrupts Test	X					X	X					
6.3.3	IMU Operate Power On Test		X	X	X	X		X	X		X		X
6.3.4	Temperature Control Verification		X	X				X	X		X		X
6.3.5	PGNCS Power Supply Test			X	X	X		X	X		X		X
6.3.6	IMU Operational Test	X	X	X	X	X		X	X		X		
6.3.7	PGNCS Operational Test		X	X	X			X	X		X		X
6.3.8	IRIG Scale Factor Test		X	X		X		X	X		X		
6.3.9	IMU Performance Test		X	X		X		X	X		X		
6.3.10	LGC Voltage Margin Test	X						X					
6.3.11	LGC Clock Frequency Test	X						X		X			
6.3.12	Gimbal Friction Test		X	X				X	X		X		X
6.3.13	Stabilization Loop Response Test		X	X		X		X	X		X		
6.3.14	G&N Fine Alignment Test		X	X	X			X	X		X	X	
6.3.15	AOT Functional Performance Test											X	
6.2.1	Emergency Shutdown Procedure	*	*	*	*	*	*	*	*	*	*	*	*
6.2.2	Normal Shutdown Procedure	*	*	*	*	*	*	*	*	*	*	*	*
6.2.3	Initial Turn-On Procedure	*	*	*	*	*	*	*	*	*	*	*	*
6.2.4	General Turn-On Procedure	*	*	*	*	*	*	*	*	*	*	*	*

*To be used as necessary to turn system on or off

Paragraph No.	Test Title
6.3.1	Standby Power In Test
6.3.2	Alarms and Interrupts Test
6.3.3	IMU Operate Power On Test
6.3.4	Temperature Control Verification
6.3.5	PGNCS Power Supply Test
6.3.6	IMU Operational Test
6.3.7	PGNCS Operational Test
6.3.8	IRIG Scale Factor Test
6.3.9	IMU Performance Test
6.3.10	LGC Voltage Margin Test
6.3.11	LGC Clock Frequency Test
6.3.12	Gimbal Friction Test
6.3.13	Stabilization Loop Response Test
6.3.14	G&N Fine Alignment Test
6.3.15	AOT Functional Performance Test

T G&N TESTS [illegible]

FIGURE 1

5.6.1.2 Failure to be within the maximum values of D_1, D_2, and D_3 after the retest sequence of 5.6.1.1 shall constitute a failure of the assembly.

5.6.2 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N System as non-conforming. Normal test sequence may be continued upon determination of the cause of the nonconformance or at the discretion of the G&N contractor test team if it is determined that such action is not detrimental to the G&N System or other interfacing subsystems. All nonconformances shall be investigated and cleared by waivers (F.N.N.), correction of specification, or hardware replacement and retest. The suspected malfunctioned hardware shall be removed and returned to the laboratory where the malfunction shall be verified. Only after malfunction verification shall a flight certified replaceable element be installed in the G&N System.

5.7 Retest subsequent to replacement of a malfunctioned assembly with that of a flight certified assembly shall be at the discretion of NASA Engineering. Table I can be used as a guide to determine general retest requirements. In all retest procedures, the test sequence of Figure 2 shall be adhered to.

5.8 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps pertaining directly to the G&N components. If any questions arise concerning the test equipment, the Test Conductor should refer to the respective operational manuals.

5.9 Spacecraft systems other than the G&N System may be operating on a noninterfering basis while individual system checkout of the G&N is being conducted.

5.10 DATA RETRIEVAL

5.10.1 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance reading shall be recorded and flagged by appropriate signals.

5.10.2 During G&N system testing, all interleaved data, Uplink Command Files and Downlink Data File shall be maintained (recorders On). All A/B PCM data that is not made available to the ACE displays shall be verified by requesting a time history data strip out of said data for the time period when the test was performed.

6. DETAILED REQUIREMENTS

6.1 INITIAL TEST CONDITIONS

6.1.1 The IMU shall be supplied with heater power on a continuous basis. The Portable Temperature Controller (Model No. 410-31058) shall be connected at all times although heater power may be supplied from the +28 VDC IMU STANDBY bus and monitored through ACE.

6.1.2 The IMU shall never be without heater power longer than 15 minutes.

6.2 OPERATIONAL REQUIREMENTS

6.2.1 Emergency Shutdown Procedure

CAUTION

In the event of any malfunction which might damage the G&N System before the normal shutdown procedure in 6.2.2 can be performed, power shall be removed from the G&N System as soon as possible. If at all possible, without creating any delay, IMU Operate power should be removed first.

6.2.2 Normal Shutdown Procedure

6.2.2.1 The normal shutdown of a G&N System shall include parking the gimbals prior to removing IMU Operate Power. This is accomplished in the following procedure.

6.2.2.2 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+09000 ENTR

6.2.2.3 On the CRT, verify the following gimbal angles are displayed:

IG is between 358 and 002
MG is between 088 and 092
OG is between 358 and 002
Verify Gimbal Lock Lamp is lighted.

6.2.2.4 Pull out +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11 to remove IMU OPERATE power.

6.2.2.4.1 On K-148 enter the following:

VERB 21	NOUN 01	ENTR
00322		ENTR
00000		ENTR

Verify that NO ATT and GIMBAL LOCK lamp indications are OFF.

6.2.2.5 Pull out +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11 to remove LGC OPERATE power.

6.2.2.6 Pull out +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11 to remove IMU STANDBY power.

6.2.3 Initial Turn-On Procedure

6.2.3.1 Proper coolant flow shall be verified prior to application of any power to the G&N System.

6.2.3.2 The initial power turn-on sequence shall be in the order specified in the test procedures (6.3) observing all cautions and delays as specified.

6.2.4 General Turn-On Procedure

6.2.4.1 This step shall be effective only after having completed the initial turn-on procedures.

6.2.4.2 Proper coolant flow shall be verified.

6.2.4.3 Depress +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11 to supply IMU STANDBY power. Record time.

6.2.4.4 Depress +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11 to supply LGC Operate power. The Restart lamp may come on, if it does press RSET on the DSKY.

6.2.4.6 On K-148 enter the following sequence:

ERROR RESET
VERB 36 ENTR (fresh start)
VERB 57 ENTR
00015 ENTR (clear erasable memory)
VERB 21 NOUN 27 ENTR
77777 ENTR (LGC Self Check)

6.2.4.7 On the CRT, verify that the 3.2 KC 28V Supply indicates between 28.04 and 29.16 VRMS (CG 1331).

6.2.4.8 On the CRT, verify that R1 does not display 01102 or 41102 (indicating a malfunction).

6.2.4.9 Wait 5 minutes then enter the following in K-148.

a.	VERB 34	ENTR
b.	VERB 21 NOUN 27	ENTR
c.	00000	ENTR
d.	VERB 25 NOUN 01	ENTR
e.	03770	ENTR SET LOC.
f.	10067	ENTR CSS NEW JOB
g.	04317	ENTR TC CHANG 1
h.	01770	ENTR TC ACTLITON
i.	VERB 25 NOUN 26	ENTR CALL PRIO/DELAY
j.	01000	ENTR 01 PRIORITY
k.	01770	ENTR RELATIVE E-MEM
m.	00007	ENTR BANK ADD.
n.	VERB 30	ENTR REQ EXEC.

NOTE: If a VERB 36 is performed after the above information has been entered, repeat lines 6.2.4.9.f through 6.2.4.9.j.

6.2.4.10 CAUTION: LGC OPERATE AND IMU STANDBY power must have been applied a minimum of two hours before energizing the IMU OPERATE circuit breaker in step 6.2.4.16 unless all of the following conditions are met:

IF: 1. The G&N System has previously been in Standby Mode at least two hours and subsequently been in Operate Mode, AND

2. The gimbals were placed in a parked position prior to shutdown, AND

3. The shutdown period did not exceed 5 days, AND

4. The Spacecraft or IMU have not been moved in any way during the shutdown period.

THEN: The two-hour standby Mode operation requirement is reduced to 15 minutes.

6.2.4.11 The G&N System is defined as being in Standby Mode when LGC Operate and IMU Standby power is applied and IMU Operate power is off. The inertial components shall have suspension power in Standby Mode.

6.2.4.12 The G&N System is defined as being in Operate Mode when LGC OPERATE, IMU STANDBY and IMU Operate Power is applied to the system.

6.2.4.13 Set up analog recorder to monitor the following signals:

	Signal No.	Signal Name
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 CPS

6.2.4.14 Start the analog recorder at a chart speed of 5 mm/sec. Start event recorder at a chart speed of 1 mm/sec.

6.2.4.15 On CRT, monitor +120 VDC PIPA SUPPLY (GG1040) and IMU gimbal angles. Record time. If 15 minutes have elapsed since performing Paragraph 6.2.4.3, proceed to the next paragraph.

6.2.4.16 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.2.4.17 Verify on analog recorder that the oscillations of the resolver sine signals (GG2112, GG2172 and GG2142) are not sustained and that the signals damp out within 15 seconds. If this condition is not attained, remove IMU OPERATE power immediately.

6.2.4.18 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.2.4.16 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.2.4.16.

6.2.4.19 Verify absence of LGC WARNING, ISS WARNING, and PGNCS CAUTION lights in the LEM cabin.

6.2.4.20 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.2.4.21 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.2.4.22 On the CRT, scan the power supply voltages to verify their normal operation. (No indications flashing).

6.2.4.23 After all the tests of 6.3 in Figure 1 have been completed, the General Turn-On Procedure (6.2.4) and IMU Operational Test (6.3.6) shall be completed before re-running any test. Otherwise, the testing sequence shall continue in accordance with Figure 2.

6.2.5 Interruption of Power

6.2.5.1 IMU Operate power shall never be applied without the presence of LGC Operate and IMU Standby Power.

6.2.5.2 The G&N System log book shall include the gimbal positions at time of power shutdown. If omitted, it shall be assumed that the gimbals were not parked prior to shutdown. The log book shall also state if any movement of the IMU or Spacecraft has taken place after shutdown. The times of application and removal of any bus power to the G&N System shall be recorded.

6.2.5.3 After the system has been operating with IMU Operate power on, and a power interruption occurs, immediately set the IMU Operate power circuit breaker to OFF. When power is restored a minimum of 15 minutes operation in Standby Mode is required before resuming IMU Operate power. If the power interruption was longer than 15 minutes, the G&N System shall be run in Standby Mode for a time interval at least equal to the duration power was off before resuming IMU Operate power. However, this period need not exceed two hours before application of IMU Operate power.

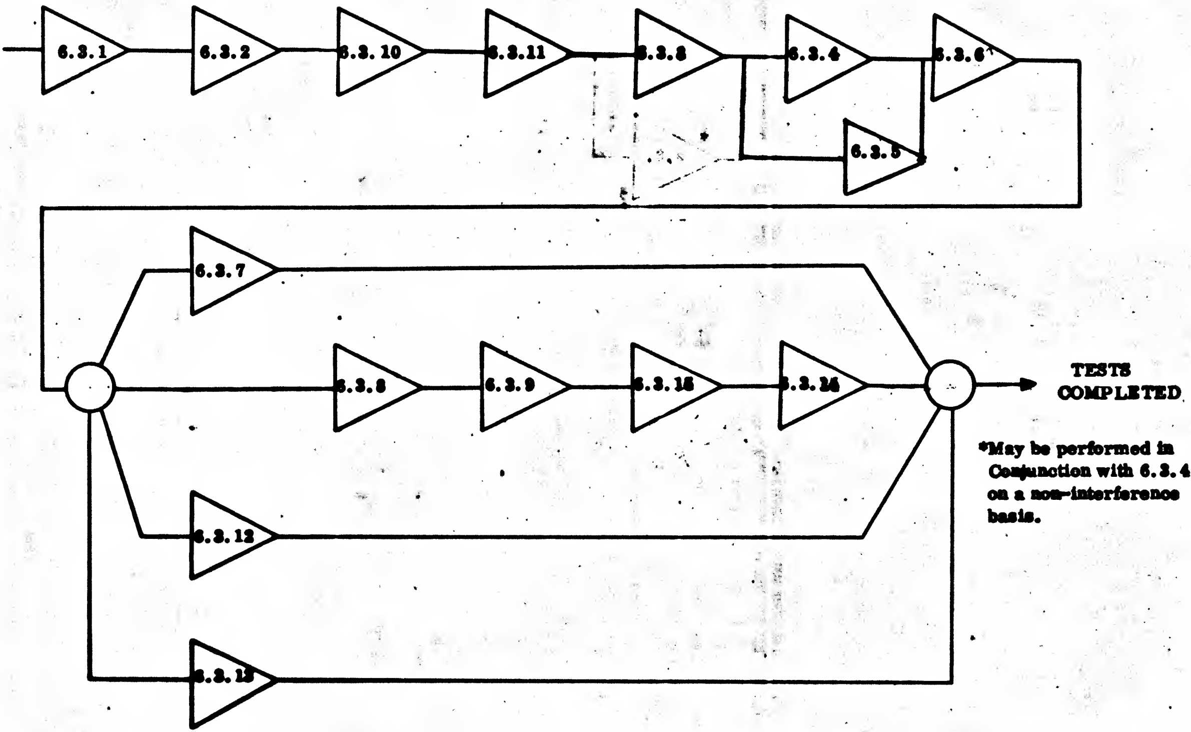
6.2.6 A warmup period of at least one hour in Operate mode is required prior to performing any test in which gyro or accelerometer parameters are measured, and at least 15 minutes prior to any test in which precision amplitude and frequency power supply checks are made.

6.3 TEST PROCEDURES

6.3.1 Standby Power On Tests

6.3.1.1 The Portable Temperature Controller, Model No. 400-31058 shall be supplying inertial component heater power to the G&N System through connecter 56J1 (P230). If alarm or fail indications are present on the PTC, they shall be cleared by depressing the SYSTEM RESET pushbutton on the PTC.

6.3.1.2 Verify that spacecraft power checks, including both polarity as well as magnitude on the spacecraft power connectors, have been accomplished.



*May be performed in Conjunction with 6.3.4 on a non-interference basis.

TEST PROCEDURE FLOWGRAM

FIGURE 2

6.3.1.3 The following switches and/or circuit breakers shall be closed to energize the indicated buses.

LOCATION	NOMENCLATURE	IDENTIFICATION
Panel 14	BAT 5 NORMAL FEED	4S10
Panel 14	BAT 6 NORMAL FEED	4S11
Panel 16	X LUNAR BUS TIE	4CB5
Panel 16	BAT 1-4-6 FEED TIE	4CB17
Panel 16	BAT 2-3-5 FEED TIE	4CB25
Panel 16	ASC ECA	4CB14
Panel 16	ASC ECA CONT.	5CB7
Panel 16	DC BUS VOLT	4CB21
Panel 16	DISP.	4CB16
Panel 11	X LUNAR BUS TIE	4CB4
Panel 11	BAT 1-4-6 FEED TIE	4CB18
Panel 11	BAT 2-3-5 FEED TIE	4CB26
Panel 11	ASC ECA	4CB15
Panel 11	ASC ECA CONT.	4CB6
Panel 11	DC BUS VOLT	4CB22
Panel 16	INV. NO. 2	4CB13
Panel 14	AC PWR to INV 2 Position	4S14
Panel 11	AC BUS FEED TIE	4CB24
Panel 11	AC BUS VOLT	4CB27

6.3.1.4 IMU Standby Power Turn On

6.3.1.4.1 Turn on Event Recorder at a speed of 1 mm/sec.

6.3.1.4.2 Press in +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11. Record time.

6.3.1.4.3 Verify on event recorder that +28 VDC IMU STANDBY power discrete (GG1513) is on. On CRT, +28V IMU STANDBY Bus (GG1510) shall indicate between 24.5 and 33.5.

6.3.1.4.4 The PIPA TEMP displayed on CRT, shall be monitored periodically for one hour to ensure that the PIPA Temperature Control circuitry is operating to maintain a temperature of 130±5.0 DEG F. (GG2300). One hour after performing step 6.3.1.4.2 record PIPA TEMP. The PIPA temperature shall be 130.5° ±1.5°F. The IRIG temperature shall be within +3.0°F of the PIPA Temperature.

6.3.1.5 Computer Power Turn On

6.3.1.5.1 Press in +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11.

6.3.1.5.2 On CRT, +28V LGC Operate Bus (GG1520) shall indicate between 24.5 and 33.5. Ignore computer alarm indications. Verify on event recorder that +28V LGC OP (GG1523X) discrete is ON. Using DSKY, enter VERB 36 ENTR then press RSET. All Computer alarms shall clear.

6.3.1.5.3 On CRT, the +14 VDC LGC SUPPLY (GG1020) shall indicate between 13.6 and 14.4 VDC. Record this value.

6.3.1.5.4 On CRT, the +4 VDC LGC SUPPLY (GG1030) shall indicate between 3.8 and 4.2 VDC. Record this value.

6.3.1.5.5 On CRT the 28V 3200 CPS SUPPLY (GG1331) shall indicate between 28.04 and 29.16 vrms. Record this value.

6.3.1.6 LGC Operational Tests

6.3.1.6.1 DSKY Check

6.3.1.6.1.1 Initiate the DSKY check by entering in the DSKY:

Press ERROR RESET
VERB 57 ENTR 00015 ENTR (clear erasable memory)
VERB 21 NOUN 27 ENTR
00011 ENTR

6.3.1.6.1.2 All the electroluminescent elements (PROG, VERB, NOUN, and Row 1, Row 2, Row 3) shall display the decimal number (9). Including the 9's, each of the following shall be displayed for approximately 5 seconds.

a. 9's
b. 8's
c. 7's
d. 6's
e. 5's
f. 4's
g. 3's
h. 2's
i. 1's
j. 0's
k. Minus signs in Row 1, ROW 2, ROW 3 } On concurrently for 5 seconds
l. VERB-NOUN flashing
m. COMP ACTY
o. Plus signs in ROWS 1, 2, and 3 } On concurrently for 5 seconds
p. VERB-NOUN Flashing
q. COMP ACTY
r. COMP ACTY - On for 5 seconds then DSKY blanks.

6.3.1.6.1.3 The DSKY pushbuttons shall be checked by entering:

VERB 25 NOUN 01 ENTR
01740 ENTR
+00123 ENTR
-00456 ENTR
-00789 DO NOT press ENTR
The DSKY shall display +00123 in Row 1, -00456 in Row 2, and -00789 in Row 3. Press CLR pushbutton three times on DSKY. Observe that Row 1, Row 2, and Row 3 are blank.

6.3.1.6.2 Lamp Test

6.3.1.6.2.1 Initiate the Lamp Test by entering in the DSKY:

VERB 35 ENTR

6.3.1.6.2.2 The following DSKY displays shall illuminate for approximately 5 seconds. On CAUTION/WARNING panel, the following displays shall illuminate, then extinguish:

LGC
ES
PGNS

a. UP LINK ACTY
b. NO ATT
c. STBY
d. KEY REL flashing
e. TEMP
f. GIMBAL LOCK
g. PROG
h. RESTART
i. TRACKER
j. OPR ERROR Flashing
k. VERB-NOUN Flashing
l. Plus 88888 in Row 1, Row 2, and Row 3

On concurrently for approximately 5 seconds.

6.3.1.6.3 Uplink Check

6.3.1.6.3.1 On K-START 148; set LOAD/INHIBIT switch to LOAD, set TAPE/KEY switch to KEY, then enter the following:

ERROR RESET
VERB 25 NOUN 01 ENTR
02400 ENTR
+01234 ENTR
-56789 ENTR
+00000 ENTR

6.3.1.6.3.2 Verify the following is displayed on the DSKY.

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.4 Downlink Check

6.3.1.6.4.1 On CRT, DSKY display, verify the following is displayed:

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.5 LGC Self-Check

6.3.1.6.5.1 On K-148;

VERB 36		ENTR
VERB 21	NOUN 27	ENTR
77777		ENTR
VERB 15	NOUN 01	ENTR
01366		ENTR

6.3.1.6.5.2 On the CRT, DSKY display, verify that R1 does not display 01102 or 41102. If a malfunction occurs, the following is displayed:

R1 01102 or 41102
R2 XXXXX c (S FAIL) program address +1 of point of failure
R3 XXXXX number of fails

6.3.1.6.5.3 When R3 = 00002, stop the LGC Self Check by entering in K-148 the following:

VERB 34 ENTR
VERB 21 NOUN 27 ENTR
00000 ENTR

6.3.1.6.6 LGC Standby Check

6.3.1.6.6.1 On K-148 enter the following sequence:

VERB 60 ENTR
Verify on CRT ABL-LGC-STBY is ON

6.3.1.6.6.2 On DSKY depress STBY pushbutton for approximately 3 seconds.

6.3.1.6.6.3 Verify STBY status indicator lamp is ON.

6.3.1.6.6.4 On the CRT, verify the 3.2 KC 28V Supply (GG1331) is between 28.04 and 29.16V RMS.

6.3.1.6.6.5 On DSKY depress STBY pushbutton for approximately 3 seconds to return to LGC OPERATE mode.

6.3.1.6.6.6 Verify STBY status indication lamp is OFF. Press ERROR RESET pushbutton. Enter VERB 61 ENTR on K-148. Verify on CRT ABL-LGC-STBY is OFF.

6.3.1.6.7 Standby/Proceed Check

6.3.1.6.7.1 On K-148 enter the following:

VERB 11 NOUN 10 ENTR
00032 ENTR

6.3.1.6.7.2 On the DSKY press and hold the STBY pushbutton. Verify Row 1 of the DSKY displays 57777.

6.3.2 Alarms and Interrupts Test

6.3.2.1 Parity Fail Test

6.3.2.1.1 On K-148 enter the following sequence

VERB 21 NOUN 02 ENTR
01600 ENTR
33777 ENTR

6.3.2.1.2 On CRT, DSKY display, verify R1 = 33777 and R3 = 01600

6.3.2.1.3 On K-148 enter the following sequence

VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.1.4 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.1.5 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.2 Rupt Lock-Interrupt Too Long

6.3.2.2.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
00001 ENTR
01600 ENTR
00003 ENTR
VERB 31 ENTR

6.3.2.2.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.2.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.3 TC Trap Test

6.3.2.3.1 On K-148 enter the following sequence

VERB 21 NOUN 01 ENTR
01600 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.3.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.3.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.4 Nightwatchman Test

6.3.2.4.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
03400 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.4.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.4.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.3 IMU OPERATE POWER ON TESTS

NOTE: Perform the following DSKY entries before continuing. If a VERB 36 is performed after the above information has been entered repeat lines f through j.

a.	VERB 25 NOUN 01	ENTR
b.	03770	ENTR SET LOC
c.	10067	ENTR CCS NEW JOB
d.	04317	ENTR TC CHANG 1
e.	01770	ENTR TC ACTLITON
f.	VERB 25 NOUN 26	ENTR CALL PRIO/DELAY
g.	01000	ENTR 01 PRIORITY
h.	01770	ENTR RELATIVE E-MEM
i.	00007	ENTR BANK ADD
j.	VERB 30	ENTR REQ EXEC.

CAUTION

Prior to application of IMU OPERATE power in step 6.3.3.1.4, LGC OPERATE and IMU STANDBY power must have been applied to the G&N System continuously for a minimum of two hours. The only exception is when the requirements of step 6.2.4.10 are met and this does not apply for the initial application of IMU OPERATE power.

6.3.3.1 Verification of Power Turn-On

6.3.3.1.1 Set up analog recorder to monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps
h.	SPARE	

6.3.3.1.2 Start analog recorder to a chart speed of 5 mm/sec. Start event recorder at a chart speed of 1 mm/sec.

6.3.3.1.3 On CRT, monitor +120 VDC PIPA SUPPLY (GG1040) and IMU gimbal angles.

6.3.3.1.4 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.3.3.1.4.1 Verify that the NO ATT Light on the DSKY is lighted.

6.3.3.1.5 Verify on analog recorder that the oscillations of the resolver sine signals (GG2112, GG2172, and GG2142) are not sustained and that the signals damp out within 15 seconds. If they don't, remove IMU OPERATE power as soon as possible.

6.3.3.1.6 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.3.3.1.4 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.3.3.1.4.

6.3.3.1.7 On event recorder verify the following:

LGC WARNING is OFF (GG9001)
ISS WARNING is OFF (GG9002)
PGNCS CAUTION is OFF (GG9003)

6.3.3.1.7.1 On DSKY, verify that the NO ATT light is off.

6.3.3.1.8 On CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.3.1.9 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.4 Temperature Control Verification

6.3.4.1 When 15 minutes have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP (GG2300). The measured temperature shall be within 0.5° of PIPA TEMP measured in 6.3.1.4.5.

6.3.4.2 When 30 minutes have elapsed from the time of IMU OPERATE power turn-on record IRIG TEMP (GG2301).

6.3.4.3 When 1 hour has elapsed from the time of IMU OPERATE power turn-on, monitor PIPA TEMP (GG2300) and IRIG TEMP (GG2301) on the CRT. Monitor and record temperature readings every 5 minutes for 30 minutes. Verify that each reading does not deviate from the average value of each signal by more than 0.1°F.

6.3.4.4 The PIPA temp shall be 130.5 (±1.5°)F. The IRIG TEMP shall be 135°(±2.5°)F.

6.3.4.5 The PIPA TEMP recorded in step 6.3.4.4 shall be within 1.0°F of the temperature recorded in step 6.3.1.4.5 and within 0.5° of the temperature recorded in 6.3.4.1.

6.3.4.6 The IRIG TEMP recorded in step 6.3.4.4 shall be within 0.5°F of the temperature recorded in step 6.3.4.2.

6.3.4.7 Verify on the event record the IMU Blower Current (GG 2303) and IMU Heater Current (GG 2302) "on" discretes have been present for the last hour (discretes may cycle off).

6.3.5. PGNCS Power Supply Tests

6.3.5.1 From the CRT, confirm power supply voltages (or temperatures) are as specified and record values observed.

6.3.5.2 The PIPA Calibration Module Temperature (GG6020) shall be between +45 and +90 DEG F.

6.3.5.3 The PSA Temperature (GG6021) shall be between +60 and +110 DEG F.

6.3.5.4 The LGC Temperature (GG4300) shall be between +45 and +130 DEG. F.

6.3.5.5 The +28 VDC IMU OPERATE BUS (GG1500) shall be between 24.5 and 33.5 VDC.

6.3.5.6 The +28 VDC IMU STANDBY BUS (GG1510) shall be between 24.5 and 33.5 VDC.

6.3.5.7 The +28 VDC LGC OPERATE BUS (GG1520) shall be between 24.5 and 33.5 VDC.

6.3.5.8 The +120 VDC PIPA Supply (GG1040) shall be between 114 and 126 VDC.

6.3.5.9 The -28 VDC Supply (GG1100) shall be between -21.5 and -33.5 VDC.

6.3.5.10 The +4 VDC CDU Supply (GG1070) shall be between 3.8 and 4.2 VDC.

6.3.5.11 The IMU 28V 800 CPS 1 pct Supply (GG1201) shall be between 27.44 and 28.56 VRMS.

6.3.5.12 The IMU 28V 800 CPS 5 pct 90 PH Supply (GG1202) shall be between 26.6 and 29.4 VRMS.

6.3.5.13 The IMU 28V 800 CPS 5 pct 0 PH Supply (GG1203) shall be between 25.9 and 30.1V RMS.

6.3.5.14 The 3.2 KC 28V Supply (GG1331) shall be between 28.04 and 29.16V RMS.

6.3.5.15 The 2.5 VDC T/M Bias (GG1110) shall be between 2.4 and 2.6 VDC.

6.3.5.16 The +14 VDC LGC Supply (GG1020) shall be between 13.6 and 14.4 VDC.

6.3.5.17 The +4 VDC LGC Supply (GG1030) shall be between 3.8 and 4.2 VDC.

6.3.5.18 The phase difference between the 3.2 KC supply and LGC sync shall be 0° ±10° (NG1336).

6.3.5.19 Record the noise levels of the following signals displayed on the CRT.

Item No.	Measurement No.	Signal	Requirement
a.	NG 1021	14 vdc LGC Noise rms	<0.4V rms
b.	NG 1031	4 vdc LGC Noise rms	<0.4V rms
c.	NG 1071	4 vdc CDU Noise rms	<1.0V rms
d.	NG 1501	28 vdc IMU Operate Noise rms	<1.0V rms
e.	NG 1511	28 vdc IMU Standby Noise rms	<1.0V rms
f.	NG 1521	28 vdc LGC Operate Noise rms	<2.0V rms

6.3.5.20 The noise peaks of the following signals are demonstrated on the event lights when the peaks have a rise time between 2 and 50 usec and the peak voltage exceeds 5 volts.

Item No.	Measurement No.	Signal
a.	NG 1022	14 vdc LGC Noise Peak
b.	NG 1032	4 vdc LGC Noise Peak
c.	NG 1072	4 vdc CDU Noise Peak
d.	NG 1502	28 vdc IMU Operate Noise Peak
e.	NG 1512	28 vdc IMU Standby Peak
f.	NG 1522	28 vdc LGC Operate Peak

6.3.6 IMU OPERATIONAL TEST

6.3.6.1 On K-148 enter the following:

VERB 01 NOUN 10 ENTR
00003 ENTR
Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.6.2 On K-148 enter the following:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 02 ENTR
01300 ENTR
Record CRT DSKY Row 1 indication as ±BBBBB

6.3.6.3 Perform the following calculations:

a. $\frac{BBBBB \times 5.12}{3600} = CCCC.C$ (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours

c. DDD.D + time of day recorded in 6.3.6.1 = time of day at which high order scalar register will overflow.

6.3.6.4 If time of day is within 12 minutes of that calculated in 6.3.6.3.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.6.3.c has passed and proceed.

6.3.6.5 In K-148 enter the following sequence:

VERB 57 ENTR
00004 ENTR

6.3.6.6 Wait 200 seconds, then verify on the CRT, that the X, Y and Z PIPA SG Output signals all indicate 0.0±2.5 Volts but not 0.

6.3.6.7 Approximately 12 minutes after performing step 6.3.6.1, VERB 06 NOUN 66 shall flash.

6.3.6.8 From the CRT, DSKY display, read and record R1 and R2 (local gravity whole and fractional respectively). The value recorded shall be between 975.0 and 985.9 cm/sec^2.

6.3.6.9 On K-148 enter the following sequence.

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.6.10 From the CRT, DSKY display, read and record the horizontal fractional component of earth rate acting on the X, Y, and Z IRIG's as displayed in R2. The value recorded shall be between .65750 and .85750.

6.3.6.11 Terminate the test by entering in K-148 the following:

VERB 33 ENTR
VERB 16 NOUN 60 DISPLAYED
VERB 34 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.7 PGNCS Operational Test

6.3.7.1 Start the PGNCS Operational test by inserting the following sequence into K-148:

VERB 57 ENTR
00010 ENTR
Program 07 shall be displayed
VERB 33 NOUN 01 is displayed flashing

6.3.7.2 Command Accuracy 0°

6.3.7.2.1 On K-148, press ENTR

VERB 33 NOUN 02 is displayed flashing
On Event Module ISS WARNING Lamp may light
Press ENTR
VERB 33 NOUN 03 is displayed flashing

6.3.7.2.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 000±001 degrees.

6.3.7.2.3 Read and record CRT the DSKY Row 1, 2, and 3 indications. The indications shall be +00000±00007.

6.3.7.3 Command Accuracy 45°

6.3.7.3.1 On K-148, press ENTR, VERB 33 NOUN 04 is displayed flashing after approximately 20 seconds.

6.3.7.3.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 045±001 degrees.

6.3.7.3.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +04500±00007.

6.3.7.4 CDU Repeating Accuracy 45°

6.3.7.4.1 On K-148 press ENTR. In about 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.4.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.5 Command Accuracy 90°

6.3.7.5.1 On K-148 Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 06 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.5.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 090±001 degrees.

6.3.7.5.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be +09000±00007.

6.3.7.6 Command Accuracy 135°

6.3.7.6.1 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 07 is displayed flashing.

6.3.7.6.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 135±001 degrees.

6.3.7.6.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +13500±00007.

6.3.7.7 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 10 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.8 CDU Repeating Accuracy 135°

6.3.7.8.1 On K-148 press ENTR pushbutton. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.8.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.9 + Gimbal Lock Test

6.3.7.9.1 On K-148, Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 12 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.10 Command Accuracy 225°

6.3.7.10.1 On K-148 press ENTR. In approximately 20 seconds, VERB 33, NOUN 13 is displayed flashing.

6.3.7.10.2 Read and record the CRT indication of IMU gimbal angles. The indication shall be 225±001 degrees.

6.3.7.10.3 Read and record CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +225±00007.

6.3.7.11 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 14 is displayed. The GIMBAL LOCK lamp shall not be lighted.

6.3.7.12 CDU Command Rate Test

6.3.7.12.1 On K-148 press ENTR. In approximately 30 seconds VERB 06 NOUN 66 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.12.2 Read and record the CRT DSKY Row 1, 2, and 3 indications. The indication shall be between 00012 and 00016.

6.3.7.12.3 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.12.4 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on the DSKY shall not be lighted.

6.3.7.13 Command Accuracy 315° .

6.3.7.13.1 On K-148 insert VERB 33 ENTR. In approximately 20 seconds VERB 33 NOUN 20 will be displayed flashing.

6.3.7.13.2 Read and record CRT indication of IMU gimbal angles. The indications shall be 315±001 degrees.

6.3.7.13.3 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indications shall be +315±00007.

6.3.6.14 CDU Repeating Accuracy 315°

6.3.7.14.1 On K-148 press ENTR. In approximately 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.14.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.15 -Gimbal Lock Test

6.3.7.15.1 On K-148 Press VERB 33 ENTR. In approximately 20 seconds VERB 33, NOUN 22 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.15.2 On K-148 Press ENTR. In approximately 20 seconds VERB 33 NOUN 23 will be displayed flashing.

6.3.7.15.3 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indications shall be

Row 1 22500±00007
Row 2 22500±00007
Row 3 00000±00007

6.3.7.16 CDU Repeating Accuracy 225°

6.3.7.16.1 On K-148, press ENTR. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.16.2 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indication shall be between 77774 and 00003.

6.3.7.17 On K-148 Press VERB 33 ENTR. The GIMBAL LOCK lamp shall not be lighted. VERB 21, NOUN 22 is displayed flashing.

6.3.7.18 IMU CDU Fine Fail Test

6.3.7.18.1 On K-148 insert the following sequence

+00100 ENTR
+00100 ENTR
+00100 ENTR
On Event Module verify that ISS WARNING lamp lights in approximately 90 seconds.

6.3.7.18.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display Row 1 indicates 33XXX or 32XXX.

6.3.7.19 IMU CDU Coarse Fail Test

6.3.7.19.1 On K-148 insert the following sequence

VERB 33 ENTR
+03378 ENTR
+03378 ENTR
+03378 ENTR
On Event Module verify that ISS WARNING lamp lights in approximately 90 seconds.

6.3.7.19.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display of Row 1 indicates 33XXX or 32XXX.

6.3.7.20 FDAI Linearity Test

6.3.7.20.1 On K-148 enter VERB 33 ENTR
VERB 33 NOUN 27 shall be displayed.

6.3.7.20.2 On CRT verify the following:

PITCH ATT ERROR is between +15.3 and +18.7 DEG (GG2219)
YAW ATT ERROR is between +15.3 and +18.7 DEG (GG2249)
ROLL ATT ERROR is between +15.3 and +18.7 DEG (GG2279)

6.3.7.20.3 On K-148 press ENTR.
VERB 33 NOUN 30 shall be displayed.

6.3.7.20.4 On CRT verify the following:

PITCH ATT ERROR is between +14.4 and +17.6 DEG (GG2219)
YAW ATT ERROR is between +14.4 and +17.6 DEG (GG2249)
ROLL ATT ERROR is between +14.4 and +17.6 DEG (GG2279)

6.3.7.20.5 On K-148 press ENTR.
VERB 33 NOUN 31 shall be displayed

6.3.7.20.6 On CRT verify the following:

PITCH ATT ERROR is between +05.4 and +06.6 DEG (GG2219)
YAW ATT ERROR is between +05.4 and +06.6 DEG (GG2249)
ROLL ATT ERROR is between +05.4 and +06.6 DEG (GG2279)

6.3.7.20.7 On K-148 press ENTR.
VERB 33 NOUN 32 shall be displayed.

6.3.7.20.8 On CRT verify the following:

PITCH ATT ERROR is between +00.2 and -00.2 DEG (GG2219)
YAW ATT ERROR is between +00.2 and -00.2 DEG (GG2249)
ROLL ATT ERROR is between +00.2 and -00.2 DEG (GG2279)

6.3.7.20.9 On K-148 press ENTR.

VERB 33 NOUN 33 shall be displayed.

6.3.7.20.10 On CRT verify the following:

PITCH ATT ERROR is between -05.4 and -06.6 DEG (GG2219)
YAW ATT ERROR is between -05.4 and -06.6 DEG (GG2249)
ROLL ATT ERROR is between -05.4 and -06.6 DEG (GG2279)

6.3.7.20.11 On K-148 press ENTR.
VERB 33 NOUN 34 shall be displayed.

6.3.7.20.12 On CRT verify the following:

PITCH ATT ERROR is between -14.4 and -17.6 DEG (GG2219)
YAW ATT ERROR is between -14.4 and -17.6 DEG (GC2249)
ROLL ATT ERROR is between -14.4 and -17.6 DEG (GG2279)

6.3.7.20.13 On K-148 press ENTR.
VERB 33 NOUN 35 shall be displayed.

6.3.7.20.14 On CRT verify the following:

PITCH ATT ERROR is between -15.3 and -18.7 DEG (GG2219)
YAW ATT ERROR is between -15.3 and -18.7 DEG (GG2249)
ROLL ATT ERROR is between -15.3 and -18.7 DEG (GG2279)

6.3.7.21 On K-148 enter VERB 36 ENTR. The proper operation of the IMU CAGE function (consisting of steps 6.3.7.21 thru 6.3.7.23) need be performed only once during the initial PGNCS Operational Test and omitted from subsequent testing of test 6.3.7.

6.3.7.21.1 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00500 ENTR
+00500 ENTR
+00500 ENTR

6.3.7.21.2 On the CRT, verify all IMU gimbal angles indicate between 003 and 007 DEG.

6.3.7.21.3 On analog recorder, monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps

6.3.7.21.4 Start analog recorder to a chart speed of 5 mm/sec.

6.3.7.21.5 On LEM Cabin Panel 4, hold IMU CAGE momentary toggle switch in the ON position. (Do not release).

6.3.7.21.6 On analog recorder, verify the 1X Resolver Sine signals (GG2112, GG2172, GG2142) null out to less than 0.5V rms. Release IMU CAGE switch to the OFF position. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Any sustained oscillations shall be cause for immediate removal of IMU Operate power.

6.3.7.21.7 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.7.22 Stop analog recorder.

6.3.7.22.1 On K-148 insert the following:

VERB 43 ENTR
+01700 ENTR
+00600 ENTR
-01700 ENTR

On CRT verify the following:

YAW ATT ERROR is between +15.3 and +18.7 Deg. (GG2249).
PITCH ATT ERROR is between +05.4 and +06.6 Deg (GG2219).
ROTT ATT ERROR is between -15.3 and -18.7 Deg (GG2279).

6.3.7.23

VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00800 ENTR
+00100 ENTR
-00800 ENTR

6.3.7.24 On CRT verify the following:

OG 1X Resolver Sin (11°) is between +06.50° and +09.50° (GG2181).
IG 1X Resolver Sin (11°)is between -00.50 and +02.50 Deg (GG2121)
MG 1X Resolver Sin (11°) is between -06.50 and -09.50 Deg (GG2151).

6.3.7.25 On K-148 enter the following:

```
VERB 41  NOUN 20  ENTR
+00000            ENTR
+00000            ENTR
+00000            ENTR
```

6.3.8 IRIG Scale Factor Determination

6.3.8.1 Insure that the IMU Operate power and LGC Operate power have been applied for a minimum of one hour and that the IMU is not in a gimbal lock condition.

6.3.8.2 On meter module monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.8.3 On K-148 enter the following sequence:

VERB 57 ENTR
00005 ENTR

6.3.8.4 PROG 07 shall be displayed.

6.3.8.5 VERB 06 NOUN 61 shall flash.

6.3.8.6 On the CRT DSKY, Verify contents of Row 1 (Navigation Base azimuth) and Row 2 (Site latitude shall be displayed).

6.3.8.7 If values for Row 1 and Row 2 are correct, proceed to the next step.
If values for Row 1 and Row 2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR
±xxxxx ENTR (Correct navigation base azimuth)
+40748 ENTR (Correct site latitude)
Verify values in Row 1 and Row 2 are correct.

6.3.8.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.8.

6.3.8.9 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (+X IRIG Scale Factor error in part per million, Position +00001)

6.3.8.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.10.

6.3.8.11 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor error in parts per million, Position +00002).

6.3.8.12 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.12.

6.3.8.13 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position +00003).

6.3.8.14 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.14.

6.3.8.15 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row (+X IRIG Scale Factor error in parts per million, Position -00001).

6.3.8.16 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.16.

6.3.8.17 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor error in parts per million, Position -00002).

6.3.8.18 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM is ON, enter VERB 36 ENTR and repeat steps, 6.3.8.3 through 6.3.8.7 and 6.3.8.18.

6.3.8.19 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position -00003).

6.3.8.20 Repeat steps 6.3.8.8 through 6.3.8.19 twice to obtain second and third set of data.

6.3.8.21 Terminate this test by entering in K-148 the following:

```
VERB 34 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR
```

6.3.8.22 The average of the three readings of Scale Factor Error for each of the 6 positions shall be 0 ± 1750 PPM.

6.3.9 IMU Performance Test. A reference data sheet is provided at the end of this section to aid in data reduction. [illegible]

6.3.9.1 Insure that IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.9.2 On CRT display, monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.9.3 Adjust oscilloscope to display butterfly of X PIPA.

6.3.9.4 On K-148 enter the following:

```
VERB 01  NOUN 10  ENTR
00003             ENTR
```

Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.9.5 On K-148 enter the following:

```
VERB 21  NOUN 01  ENTR
01300             ENTR
AAAAA             ENTR
VERB 06 NOUN 02   ENTR
01300             ENTR
```

Record CRT DSKY Row 1 indications as ±BBBBB.

6.3.9.6 Perform the following calculations:

a. $\frac{\text{BBBBB} \times 5.12}{3600} = \text{CCCC.C}$ (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours.

c. DDDD.D + present time of day = time of day at which high order scalar register will overflow.

6.3.9.7 If the time of day is within 12 minutes of that calculated in 6.3.9.6.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.9.6.c has passed and proceed.

Paragraph

6.3.9.15
6.3.9.22
6.3.9.30
6.3.9.36
6.3.9.43
6.3.9.48

6.3.9.8 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTR
00370 ENTR
Record contents of CRT DSKY Row 1 XXXXY
VERB 21 NOUN 01 ENTR
00370 ENTR
XXXXY' ENTR
Where Y' is obtained from Table 1a.
VERB 57 ENTR
00001 ENTR
VERB 06 NOUN 61 shall flash

6.3.9.9 On the CRT, DSKY display verify R1 (Navigation Base Azimuth) and R2 (Site Latitude) are correct.

6.3.9.10 If values for R1 and R2 are correct, proceed to next step.
If values for R1 and R2 are incorrect, enter the following sequence into K-148.

VERB 24 ENTR
±xxx.xx ENTR (Correct navigation base azimuth ±0.50 deg)
+40.748 ENTR (Correct site latitude)
Verify values in R1 and R2 are correct.

6.3.9.11 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.12 On CRT, DSKY display, verify R1 = +00600 (Time), R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position). If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00600 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00001 ENTR (Test Position Entry)

6.3.9.13 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.14 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 (+NBDY Position +00001).

6.3.9.15 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.16 Deleted. ~~[illegible], take a photograph of Y and Z +IRA butterfly patterns on oscilloscope.~~

6.3.9.17 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (+X PIPA Position +00001). Row 1 is whole part, Row 2 is fractional part. Units are cm/sec^2.

6.3.9.18 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.19 On CRT, DSKY display - verify R1 = +00600, R2 = +00000, and R3 = +00002.

6.3.9.20 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.21 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDZ Position +00002).

6.3.9.22 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.23 Approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (-X PIPA Position +00002).

6.3.9.24 On K-148 enter the following sequence:

VERB 33 ENTR
Record CRT CDU gimbal angle indications and time.

6.3.9.25 In approximately 67 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDX + ADIAX Pos +00002). Record CRT CDU gimbal angle indications and time.

6.3.9.26 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.27 On CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00003.

6.3.9.28 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.29 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX Position +00003).

6.3.9.30 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.31 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Z PIPA Position +00003).

6.3.9.32 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.33 On the CRT, DSKY display verify R1 = +00600, R2 = 00000, and R3 = +00004.

6.3.9.34 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.35 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDY + ADSRAY Position +00004).

6.3.9.36 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.37 Deleted.

6.3.9.38 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (-Z PIPA Position +00004).

6.3.9.39 On K-148 enter the following sequence:

VERB 33 ENTR

Record CRT CDU gimbal angle indications and time.

6.3.9.40 In approximately 67 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display record R2 (+NBDZ + ADIAZ Position +00004). Record CRT CDU gimbal angle indications and time.

6.3.9.41 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.42 From the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00005.

6.3.9.43 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.44 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.45 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Y PIPA Position +00005).

6.3.9.46 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.47 On the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00006.

6.3.9.48 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.49 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.50 In approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2. (-Y PIPA Position +00006).

6.3.9.51 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.52 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000 and R3 = +00007.

6.3.9.53 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.54 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+.707 ADSRAX-NBDX Position +00007).

6.3.9.55 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.56 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00008.

6.3.9.57 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.58 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 [-.707 (NBDZ+NBDY) +0.5 (ADIAZ - ADIAY) +0.5 (ADSRAY + ADSRAZ)] (Position + 00008).

6.3.9.59 On K-148 enter the following:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.60 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00009.

6.3.9.61 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.62 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display, record R2 (-NBDZ + .707 ADSRAZ Position +00009).

6.3.9.63 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.64 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00010.

6.3.9.65 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.66 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 [.707 (NBDY-NBDX) +.5 (ADIAY - ADIAX) +.5 ADSRAX] (Position +00010).

6.3.9.67 Terminate this test by entering in K-148 the following:

VERB 36 ENTR

6.3.9.68 On CRT, record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).

6.3.9.69 On K-148 enter the following sequence:
VERB 41 NOUN 20 ENTER
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.9.70 Calculations

NOTE: Use Post Vibration or System Test data points only.

6.3.9.70.1 Obtain data from last IRIG and/or PIPA test and fill in Data Sheet x_{i-1}.

6.3.9.70.2 Obtain data from second last IRIG and/or PIPA test and fill in Data Sheet x_{i-2}.

6.3.9.70.3 Obtain data from third last IRIG and/or PIPA test and fill in Data Sheet x_{i-3}.

6.3.9.70.4 Perform the following calculations for each item appearing on Data Sheet x_i and transfer all results to lines au through bi.

NOTE:

See paragraph 5.6 before continuing

$$D_1 = \left| x_{i-1} - x_i \right|$$

$$D_2 = \left| x_{i-1} - x_i \right| + \left| x_{i-2} - x_{i-1} \right|$$

$$D_3 = \left| x_{i-3} - x_{i-2} \right| + \left| x_{i-2} - x_{i-1} \right| + \left| x_{i-1} - x_i \right|$$

6.3.10 LGC Voltage Margin Test

6.3.10.1 Initial Conditions

6.3.10.1.1 Insure that the G&N System is in the Standby Mode.

6.3.10.1.2 On the CRT, verify the +28 VDC LGC OPERATE bus is between 24.5 and 33.5 vdc (GG 1520).

6.3.10.2 Voltage Margin Determination

6.3.10.2.1 On the PSA Adapter Module (PSAAM) (410-31080), place INHIBIT VOLTAGE FAIL switch to ON.

CAUTION: The +4 vdc LGC Supply voltage shall never be operated lower than +2.5 vdc or higher than +5.2 vdc (GG1030).

The +14 vdc LGC Supply shall never be operated less than +8.5 vdc or higher than +17.0 vdc (GG 1020).

NOTE: The flashing indication of the LGC supplies may be disregarded for this test. The charts in Table II may be used to determine approximate values for "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9. 14	+N BDY Position +00001 Transfer result to line af	meru	( ) ---.--	a.
6.3.9. 17	+X PIPA Test Position +00001	cm/sec^2	( ) 00---. ( )-----	b.
6.3.9. 21	+N BDZ Position +00002 Transfer result to line ag	meru	( ) ---.--	c.
6.3.9. 23	-X PIPA Test Position +00002	cm/sec^2	( ) 00---. ( )-----	d.
6.3.9. 25	-N BDX + ADIAX Position +00002	meru	( ) ---, --	e.
6.3.9. 29	-N BDX Position +00003 Multiply by -1 and transfer result to line ah	meru	( ) ---.--	f.
6.3.9. 31	+Z PIPA Test Position +00003	cm/sec^2	( ) 00---. ( ) -----	g.
6.3.9. 35	+N BDY + ADSRAY Position +00004	meru	( ) ---.--	h.
6.3.9. 38	-Z PIPA Test Position +00004	cm/sec^2	( ) 00---. ( ) -----	i.
6.3.9. 40	+N BDZ + ADIAZ Position +00004	meru	( ) ---.--	j.
6.3.9. 45	+Y PIPA Test Position +00005	cm/sec^2	( ) 00---. ( ) -----	k.
6.3.9. 50	-Y PIPA Test Position +00006	cm/sec^2	( ) 00---. ( ) -----	l.

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9.54	-NBDX+ .707 ADSRAX Position +00007	meru		m.
6.3.9.58	-.707 (NBDZ+NBDY) +0.5 (ADIAZ-ADIAY) +0.5 (ADSRAY+ADSRAZ) Position +00008	meru		n.
6.3.9.62	-NBDZ+.707ADSRAZ Position +00009	meru		o.
6.3.9.66	.707(NBDY-NBDX) +.5 (ADIAY-ADIAX) +.5 ADSRAX Position +00010	meru		p.

DATA SHEET

CALCULATION	PARAMETER	UNITS	
line c - line f = ( ) ---.-- (-NBDX+ADIAX) - (-NBDX) Transfer result to line al.	ADIAX	meru/g	q
line h - line a = ( ) ---.-- (+NBDY+ADSRAY) - (+NBDY) Transfer result to ai.	ADSRAY	meru/g	r
line j - line c = ( )---.--- (+NBDZ+ADIAZ) - (NBDZ) Transfer result to line am.	ADIAZ	meru/g	s
(line m - line f)X1.414 = ( ) ---.-- [(-NBDX + .707 ADSRAX) - (-NBDX)] X 1.414 Transfer result to line ak.	ADSRAX	meru/g	t
(line o + line c) X1.414 = ( ) ---.-- (-NBDZ + .707 ADSRAZ + NBDZ) X1.414 Transfer result to line aj.	ADSRAZ	meru/g	u
(line p - .707 line a - .707 line f +.5 line q -.5 line t) X2 = ---.-- [.707 (NBDY-NBDX) +.5 (ADIAY-ADIAX) +.5 ADSRAX -.707 (-NBDX) -.707 NBDY +.5 ADIAX-.5 ADSRAX] X2 Transfer result to line an.	ADIAY	meru/g	v
line b - line d = ( )	PIPA X2G	cm/sec^2	w
line k - line l = ( )	PIPA Y2G	cm/sec^2	x
line g - line i = ( )	PIPA Z2G	cm/sec^2	y
1960.52 ÷ line w x 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line ao.	X PIPA S. F.	cm/sec/ pulse	z
1960.52 ÷ line x X 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line ap.	Y PIPA S. F.	cm/sec/ pulse	aa
1960.52 ÷ line y X 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line aq.	Z PIPA S. F.	cm/sec/ pulse	ab
1/2 (line b + line d) = ( ) --.-- Transfer results to line ar	X PIPA Bias	cm/sec^2	ac
1/2 (line k + line l) = ( ) --.--- Transfer results to line as	Y PIPA Bias	cm/sec^2	ad
1/2 (line g + line i) = ( ) --.--- Transfer results to line at	Z PIPA Bias	cm/sec^2	ae

TABLE I

Y	Y'
0	2
1	3
2	2
3	3
4	6
5	7
6	6
7	7

DATA SHEET
(x_i)

PARAMETER	UNITS	MIN VALUE	RECORDED VALUE	MAX VALUE	REJ	ACC	
NBDY	meru	-15		+15			af
NBDZ	meru	-15		+15			ag
NBDX	meru	-15		+15			ah
ADSRAY	meru/g	-40		+40			ai
ADSRAZ	meru/g	-40		+40			aj
ADSRAX	meru/g	-40		+40			ah
ADIAX	meru/g	-100		+100			al
ADIAZ	meru/g	-100		+100			am
ADIAY	meru/g	-100		+100			an
X PIPA S. F. error from line z	PPM	-1900		+1900			ao
Y PIPA S. F. error from line aa	PPM	-1900		+1900			ap
Z PIPA S. F. error from line ab	PPM	-1900		+1900			aq
X PIPA Bias from line ac	cm/sec^2	-3.1		+3.1			ar
Y PIPA Bias from line ad	cm/sec^2	-3.1		+3.1			as
Z PIPA Bias from line ae	cm/sec^2	-3.1		+3.1			at

DATA SHEET
(α_{i-1})

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru/g	
ADSRAZ	meru/g	
ADSRAX	meru/g	
ADIAX	meru/g	
ADIAZ	meru/g	
ADIAY	meru/g	
X PIPA S. F. error	PPM	
Y PIPA S. F. error	PPM	
Z PIPA S. F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET
(x_1-2)

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru/g	
ADSRAZ	meru/g	
ADSRAX	meru/g	
ADIAX	meru/g	
ADIAZ	meru/g	
ADIAY	meru/g	
X PIPA S. F. error	PPM	
Y PIPA S. F. error	PPM	
Z PIPA S. F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET
(x_1-3)

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru/g	
ADSRAZ	meru/g	
ADSRAX	meru/g	
ADIAX	meru/g	
ADIAZ	meru/g	
ADIAY	meru/g	
X PIPA S. F. error	PPM	
Y PIPA S. F. error	PPM	
Z PIPA S. F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET

PARAMETER	UNITS	D_1	MAX	D_2	MAX	D_3	MAX	
NBDY	meru		6		9		11	au
NBDZ	meru		6		9		11	av
NBDX	meru		6		9		11	aw
ADSRAY	meru/g		14		21		25	ax
ADSRAZ	meru/g		14		21		25	ay
ADSRAX	meru/g		14		21		25	az
ADIAX	meru/g		17		33		40	ba
ADIAZ	meru/g		17		33		40	bb
ADIAY	meru/g		17		33		40	bc
X PIPA S. F.	Error PPM		400		500		600	bd
Y PIPA S. F.	Error PPM		400		500		600	be
Z PIPA S. F.	Error PPM		400		500		600	bf
X PIPA Bias	cm/sec^2		0. 5		0. 7		0. 9	bg
Y PIPA Bias	cm/sec^2		0. 5		0. 7		0. 9	bh
Z PIPA Bias	cm/sec^2		0. 5		0. 7		0. 9	bi

6.3.10.2.2 Enter 0001 into R155. Verify and execute.

6.3.10.2.3 Enter 1111 into R154. Verify and execute.

6.3.10.2.4 Enter in C-156 ±XX.X001114. (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 12.1 (+0.3, −0) vdc. See Table II). Execute.

6.3.10.2.5 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the +4V power supply (GG 1030) as monitored on the CRT, to 3.5 (+0.15, −0) vdc. See Table II). Execute.

6.3.10.2.6 On K-148 press ERROR RESET.

6.3.10.2.7 On K-148 initiate LGC Self-Check by entering the following:

```
VERB 21 NOUN 27 ENTR
77767           ENTR
```

Wait 200 seconds. Verify RESTART lamp on the DSKY is not lit.

6.3.10.2.8 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.9 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations.

```
VERB 21 NOUN 27 ENTR
77767           ENTR
```

6.3.10.2.10 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 16.4 (+0, −0.4) vdc. See Table II. Execute.

6.3.10.2.11 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.12 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations.

```
VERB 21 NOUN 27 ENTR
77767           ENTR
```

6.3.10.2.13 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the 4V power supply (GG 1030) as monitored on the CRT, to 4.5 (+0, -0.2) vdc. See Table II). Execute.

6.3.10.2.14 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.

6.3.10.2.15 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lit. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:

VERB 21	NOUN 27	ENTR
77767		ENTR

6.3.10.2.16 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the 14V power supply (GG 1020) as monitored on the CRT, to 12.1 (+0.3, -0) vdc. See Table II). Execute.

6.3.10.2.17 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.18 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.19 On R-154 enter 0000. Execute.

6.3.10.2.20 On R-155 enter 0000. Execute.

6.3.10.2.21 On K-148 terminate the LGC Self-Check by entering the following:

VERB 21	NOUN 27	ENTR
00000		ENTR

6.3.10.2.22 On K-148 press ERROR RESET.

6.3.11 LGC Clock Frequency Test

6.3.11.1 Insure that LGC Operate power has been applied for a minimum of 10 minutes before performing this test.

6.3.11.2 Verify that the counter is connected to the 3.2kc signal on the hardline.

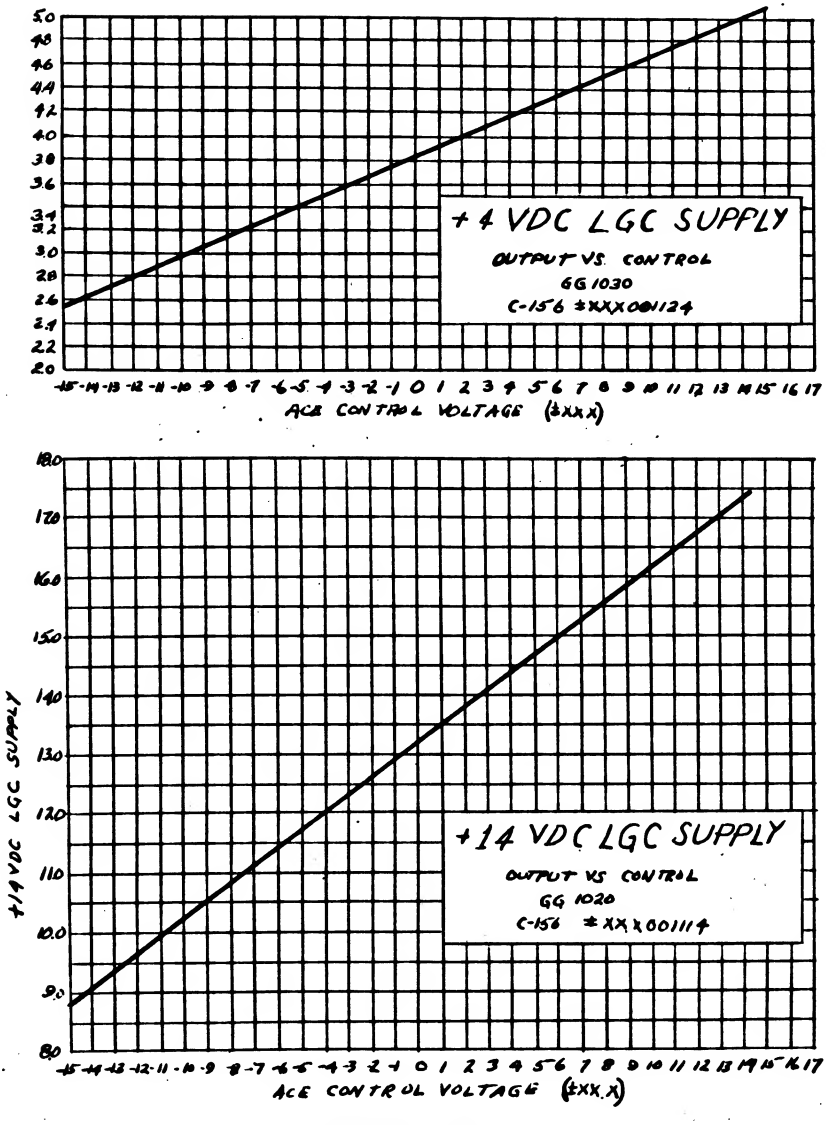

5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
+4 VDC LGC SUPPLY
OUTPUT VS CONTROL
GG 1030
C-156 ±XXX001124
-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
ACE CONTROL VOLTAGE (±XXX)
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
+14 VDC LGC SUPPLY
+14 VDC LGC SUPPLY
OUTPUT VS CONTROL
GG 1020
C-156 ±XXX001114
-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
ACE CONTROL VOLTAGE (±XX.X)

TABLE II

6.3.11.3 Insure that the counter has been warming up for a minimum of 30 minutes.

6.3.11.4 On the counter,

Set the FUNCTION switch to: MAN START
Set the TIME BASE switch to: 1 μs TIME UNIT/COUNT
Set the SENSITIVITY control to: CHECK

6.3.11.5 Verify proper counter operation.

6.3.11.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.

6.3.11.7 Plug in the Preset unit and set:

MODE switch to PRESET
N switches to 96000

6.3.11.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.

6.3.11.9 Start counting by depressing RESET switch on counter.

6.3.11.10 After approximately 30 seconds, read and record counter display.

6.3.11.11 Repeat steps 6.3.11.9 and 6.3.11.10. 9 times.

6.3.11.12 The average of the 10 previous readings shall be 30.000000±0.000060 seconds.

6.3.11.13 Insure that the System is not in IMU Operate.

6.3.11.14 Perform the following DSKY operations.

VERB 21	NOUN 10	ENTR
00013		ENTR
02000		ENTR

Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is lighted.

6.3.11.15 Repeat steps 6.3.11.9 through 6.3.11.12.

6.3.11.16 Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is not lighted.

6.3.11.17 On the Computer Control and Reticle dimmer assembly, press and hold MARK X pushbutton.

6.3.11.18 On the DSKY observe

VERB 06 NOUN 31
Row 1 = 00112
Prog Alarm lamp is lighted
Press Error Reset

6.3.11.19 Enter the following on K-148

VERB 11 NOUN 10 ENTR
00016 ENTR

6.3.11.20 Observe that DSKY Row 1 displays 00004.

6.3.11.21 Release MARK X pushbutton

6.3.11.22 Observe that DSKY Row 1 displays 00000.

6.3.11.23 Press and hold the MARK Y pushbutton on the Computer Control and Reticle Dimmer Assembly.

6.3.11.23.1 On the DSKY Observe

VERB 06 NOUN 31
Row 1 = 00112
Program Alarm lamp is lighted
Press ERR Reset

6.3.11.23.2 Enter the following on K-148:

VERB 11 NOUN 10 ENTR
00016 ENTR

6.3.11.24 Observe that DSKY Row 1 displays 00010.

6.3.11.25 Release MARK Y pushbutton

6.3.11.26 Observe that DSKY Row 1 displays 00000.

6.3.11.27 Press and hold the REJECT pushbutton on the Computer Control and Reticle Dimmer Assembly.

6.3.11.27.1 On the DSKY observe

VERB 05 NOUN 31
Row 1 = 00112
Prog alarm lamp is lighted
Press ERR Reset

6.3.11.27.2 Enter the following on K-148:

VERB 11 NOUN 10 ENTR
00016 ENTR

6.3.11.28 Observe that DSKY Row 1 displays 00020.

6.3.11.29 Release the REJECT pushbutton.

6.3.11.30 Observe that DSKY Row 1 displays 00000.

6.3.11.31 On the DSKY perform the following operation

VERB 36 ENTR

6.3.11.32 On panel 11 close PGNS AOT lamp circuit breaker. On the Computer Control and Reticle dimmer assembly, rotate the RETICLE BRIGHTNESS control to its minimum light intensity position. View through the AOT and verify that the reticle lamp is off.

6.3.11.33 While viewing through the AOT, slowly rotate the RETICLE BRIGHTNESS control, to increase the reticle brightness until a stop is reached. Observe that the reticle brightness has increased in intensity. Return RETICLE BRIGHTNESS control to off state. On panel 11 open PGNS AOT lamp circuit breaker.

6.3.11.34 AOT eyepiece Heater Test.

6.3.11.34.1 Secure milliameter HP 428B and current probe HP428A-21A.

6.3.11.34.2 Locate P1 at Computer Control and Reticle Dimmer assembly. Push lacing cord away from P1 back to fifth tie point.

6.3.11.34.3 Clip current probe HP428A-21A to blue wire in cable with red arrow pointing away from P1. Measure and record current indication. The current shall be between 139 and 244 ma.

6.3.11.34.4 Remove current probe, push lacing cord back to P1 and spot tie.

6.3.12 Gimbal Friction Test

6.3.12.1 Inner Gimbal Friction Test

6.3.12.1.1 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR
Wait 15 seconds
VERB 41 NOUN 20 ENTR
+17000 ENTR
+17000 ENTR
+17000 ENTR
Wait 15 seconds

VERB 41	NOUN 20	ENTR
+27000		ENTR
+27000		ENTR
+27000		ENTR
Wait 15 seconds		
VERB 41	NOUN 20	ENTR
+00000		ENTR
+00000		ENTR
+00000		ENTR

6.3.12.1.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.1.3 Set up Analog Recorder to monitor the following signals:

MEAS. NO.	SIGNAL NAME
a. GG2110	IG Torque Motor Current
b. GG2106	IG Servo Error Total
c. GG2107	IG Servo Error in Phase
d. GG2112	IG 1x Resolver Sine
e. GG2113	IG 1x Resolver Cosine
f. GG2220	IG CDU Fine Error
g. GG1201	IMU 28V 1% 800 CPS
h. GG2221	IG CDU Coarse Error

6.3.12.1.4 Set up Analog Recorder to monitor the following signals:

MEAS NO.	SIGNAL NAME
a. GG2300	PIPA TEMP
b. GG2301	IRIG TEMP
c. GG1520	+28 VDC LGC OPR BUS

6.3.12.1.5 After 10 seconds has elapsed since step 6.3.12.1.1, enter the following into K-148.

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.1.6 Verify on CRT, DSKY display

VERB 21	NOUN 01
R1 =	00000
R3 =	00403

6.3.12.1.7 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR
37777	ENTR	ENTR
37743	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	(once)

6.3.12.1.8 Start analog recorders using a chart speed of 10 mm/sec (IG - 360° TORQUE)

6.3.12.1.9 On K-148 enter the following sequence:

```
VERB 01    NOUN 01    ENTR
00370                 ENTR
Record contents of CRT DSKY Row 1 xxxxY
VERB 21    NOUN 01    ENTR
00370                 ENTR
XXXXY'                ENTR
Where Y' is obtained from Table 1
VERB 42               ENTR
VERB 33               ENTR
```

6.3.12.1.10 Monitor analog recorder. When the IG Torque Motor Current signal (GG2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.1.11 On K-148 enter the following sequence:

```
VERB 40    NOUN 20    ENTR    Wait 3 seconds
VERB 41    NOUN 20    ENTR
+00000     ENTR
+00000     ENTR
+00000     ENTR
```

6.3.12.1.12 On the CRT, verify CDU X, CDU Y, CDU Z all indicate +00000 (±00200).

6.3.12.1.13 After 10 seconds has elapsed since step 6.3.12.1.11 enter the following sequence into K-148:

```
VERB 21    NOUN 01    ENTR
00403      ENTR
00000      ENTR
```

6.3.12.1.14 Verify on CRT, DSKY display

VERB 21	NOUN 01
R1	00000
R3	00403

6.3.12.1.15 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR
40000	ENTR	ENTR
40034	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	(once)

6.3.12.1.16 Start analog recorders using a chart speed of 10 mm/sec (IG+360° TORQUE)

6.3.12.1.17 On K-148 enter the following sequence

VERB 42	ENTR
VERB 33	ENTR

6.3.12.1.18 Monitor analog recorder. When the IG Torque Motor Current signal (GG2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.2 Outer Gimbal Friction Test

6.3.12.2.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+00000	ENTR		

6.3.12.2.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.3 Set up analog recorder to monitor the following:

MEAS NO.	SIGNAL NAME
a. GG2167	OG Servo Error In Phase
b. GG2170	OG Torque Motor Current
c. GG2166	OG Servo Error Total
d. GG2280	OG CDU Fine Error
e. GG2172	OG 1x Resolver Sine
f. GG2173	OG 1x Resolver Cosine
g. GG2281	OG CDU Coarse Error

6.3.12.2.4 After 10 seconds has elapsed since step 6.3.12.2.1 enter the following sequence into K-148:

VERB 21	NOUN 01	ENTR
00403	ENTR	
37777	ENTR	

6.3.12.2.5 Verify on CRT, DSKY display

VERB 21	NOUN 01
R1	37777
R3	00403

6.3.12.2.6 On K-148 enter the following sequence:

NOUN 15	ENTR	
37743	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	(once)

6.3.12.2.7 Start analog recorders using a chart speed of 10 mm/sec. (OG - 360° TORQUE)

6.3.12.2.8 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.2.9 Monitor analog recorder. When the OG Torque Motor Current signal (GG2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.2.10 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+00000	ENTR		

6.3.12.2.11 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.12 After 10 seconds has elapsed since step 6.3.12.2.10, enter the following sequence into K-148.

VERB 21	NOUN 01	ENTR
00403	ENTR	
40000	ENTR	

6.3.12.2.13 Verify on CRT, DSKY display.

VERB 21	NOUN 01
R1	40000
R3	00403

6.3.12.2.14 On K-148 enter the following sequence:

NOUN 15	ENTR	
40034	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR

6.3.12.2.15 Start analog recorders using a chart speed of 10 mm/sec (OG +360° TORQUE)

6.3.12.2.16 On K-148 enter the following sequence

VERB 42	ENTR
VERB 33	ENTR

6.3.12.2.17 Monitor analog recorder. When the OG Torque Motor Current signal (GG2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.3 Middle Gimbal Friction Test

6.3.12.3.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+06750	ENTR		

6.3.12.3.2 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = +06750±00200.

6.3.12.3.3 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2136	MG Servo Error Total
b. GG2137	MG Servo Error In Phase
c. GG2140	MG Torque Motor Current
d. GG2143	MG 1x Resolver Cosine
e. GG2250	MG CDU Fine Error
f. GG2142	MG 1x Resolver Sine
g. GG2251	MG CDU Coarse Error

6.3.12.3.4 After 10 seconds have elapsed since step 6.3.12.3.1, enter the following sequence into K-148:

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.3.5 Verify on CRT, DSKY display

VERB 21 NOUN 01
R1 = 0000
R3 = 00403

6.3.12.3.6 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
14000	ENTR	ENTR
00000	ENTR	(once)

6.3.12.3.7 Start analog recorders using a chart speed of 10 mm/sec. (MG - 135° TORQUE)

6.3.12.3.8 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.3.9 Monitor analog recorder. When MG Torque Motor Current (GG2140) drops to a quiescent level (approximately 6 minutes), stop the recorders.

6.3.12.3.10 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
-06750	ENTR		

6.3.12.3.11 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = -06750±00200.

6.3.12.3.12 After 10 seconds has elapsed since step 6.3.12.3.10, enter the following sequence into K-148.

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.3.13 On the CRT, DSKY display verify:

VERB 21	NOUN 01
R1 =	00000
R3 =	00403

6.3.12.3.14 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
63777	ENTR	ENTR
77777	ENTR	(once)

6.3.12.3.15 Start analog recorders using a chart speed of 10 mm/sec. (MG + 135° TORQUE)

6.3.12.3.16 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.3.17 Monitor analog recorder. When the MG Torque Motor Current signal (GG2140) drops to a quiescent level (approximately 6 minutes) stop the recorders.

6.3.12.3.18 On K-148 enter the following sequence:

VERB 41	NOUN 20	ENTR
+00000	ENTR	
+00000	ENTR	
+00000	ENTR	

6.3.12.4 Test Analysis

6.3.12.4.1 Remove the strip charts from analog recorders

6.3.12.4.2 Examine each trace carefully to detect any sharp discontinuities of the traces. Disregard all transients less than 0.5 second (5 mm) on any Torque Motor Current signal. Disregard all transients less than 0.2 second (2 mm) on any CDU Fine Error signal.

6.3.12.4.3 No Torque Motor Current signal on (GG2140, GG2170, GG2110) shall ever exceed (0.125) amp. Sensitivity on recorder is 20 ma/division for GG2110, GG2140 and 36 ma/division for GG2170.

6.3.12.4.4 No CDU Fine Error on (GG2220, GG2280, GG2250) shall ever exceed (.070) volts. Sensitivity on recorder is 80 mv/division.

6.3.12.4.5 No CDU Coarse Error (GG2221, GG2281, GG2251) shall ever exceed 0.680 volts.

6.3.13 Stabilization Loop Step Response Test

6.3.13.1 IG Response Test

6.3.13.1.1 On K-148 enter the following sequence:

VERB 40	**NOUN 20**	**ENTR**	**Wait 3 seconds**
VERB 41	**NOUN 20**	**ENTR**	
+00000	**ENTR**		
+00000	**ENTR**		
+00000	**ENTR**		

6.3.13.1.2 On CRT, verify IG MG, and OG gimbal angles are between 358 and 002.

6.3.13.1.3 Set up analog recorder to monitor the following:

MEAS NO.	**SIGNAL NAME**
a. GG2110	**IG Torque Motor Current**
b. GG2106	**IG Servo Error Total**
c. GG2107	**IG Servo Error In Phase**
d. GG2112	**IG 1X resolver Sine**
e. GG2113	**IG 1X Resolver Cosine**
f. GG2220	**IG CDU Fine Error**
g. GG1201	**IMU 28V 1 PCT 800 CPS**

6.3.13.1.4 On K-148 initiate FINE ALIGN by entering the following sequence:

VERB 42	**ENTR**
+00000	**ENTR**
+00000	**ENTR**
+00000	**ENTR**

6.3.13.1.5 On the CRT verify CDU X, CDU Y and CDU Z indicate +00000±00200.

CAUTION: If the transients caused by the subsequent step input do not damp out within 15 seconds, remove IMU Operate Power.

6.3.13.1.6 Enter 1000 into R-START 155.

6.3.13.1.7 Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the IG stabilization loop.

6.3.13.1.8 Prepare to start analog recorder at a chart speed of 100 mm/sec. (IG RESPONSE TEST)

6.3.13.1.9 Enter 0000 into R-START 155. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the IG stabilization loop.

6.3.13.1.10 After the transient on the recorder has died out, stop the recorder.

6.3.13.1.11 From the Servo Error In Phase signal recorder trace measure the time interval (T1, Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period T1, shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.

6.3.13.2 MG Response Test

6.3.13.2.1 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2136	MG Servo Error Total
b. GG2137	MG Servo Error in Phase
c. GG2140	MG Torque Motor Current
d. GG2143	MG 1X Resolver Cosine
e. GG2250	MG CDU Fine Error
f. GG2142	MG 1X Resolver Sine
g. GG1201	IMU 28V 1% 800 cps

6.3.13.2.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).

CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU Operate power.

6.3.13.2.3 Enter 0100 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the MG stabilization loop.

6.3.13.2.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (MG RESPONSE TEST).

6.3.13.2.5 Enter 0000 into R-START 155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.

6.3.13.2.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.2.7 From the Servo Error In Phase signal recorder trace measure the time interval (T1 Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig 3). The period, T1, shall not exceed 0.1 seconds and the trace shall have no more than 3 overshoots.

6.3.13.3 OG Response Test

6.3.13.3.1 Set up analog recorder to monitor the following:

	MEAS. NO.	SIGNAL NAME
a.	GG2167	OG Servo Error In Phase
b.	GG2170	OG Torque Motor Current
c.	GG2166	OG Servo Error Total
d.	GG2280	OG CDU Fine Error
e.	GG2172	OG 1X Resolver Sine
f.	GG2173	OG 1X Resolver Cosine
g.	GG1201	IMU 28V 1% 800 cps

6.3.13.3.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).

CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU operate power.

6.3.13.3.3 Enter 0010 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the OG stabilization loop.

6.3.13.3.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (OG RESPONSE TEST).

6.3.13.3.5 Enter 0000 into R-155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the OG stabilization loop.

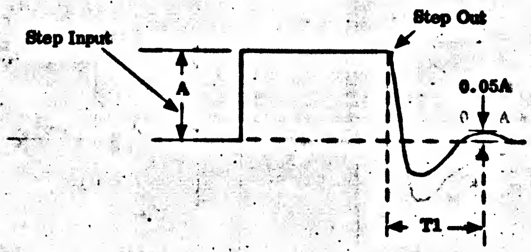
6.3.13.3.6 After the transient on the recorder has died out, stop the recorder.

/ C

6.3.13.3.7 From the Servo Error In Phase signal recorder trace, measure the time interval (T1, Fig 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig 3). The period, T1, shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.

6.3.13.3.8 On K-148 enter the following sequence:

VERB 41	NOUN 20	ENTR
+00000	ENTR	
+00000	ENTR	
+00000	ENTR	



TYPICAL STAB LOOP RESPONSE TO STEP INPUT

FIGURE 3

6.3.14 G&N Fine Alignment Test

6.3.14.1 On K-148 enter:

```
VERB 01  NOUN 10  ENTR
00003             ENTR
```

6.3.14.2 Record CRT, DSKY Row 1 display as AAAAA and the time of day.

6.3.14.3 On K-148 enter:

```
VERB 21  NOUN 01  ENTR
01300             ENTR
AAAAA             ENTR
VERB 06  NOUN 02  ENTR
01300    ENTR
```

6.3.14.4 Record CRT DSKY Row 1 display as ±BBBBB

6.3.14.5 Perform the following calculations:

a. $\frac{\text{BBBBBX 5.12}}{3600} = \text{CCCC.C}$ Contents of high order scalar register in hours.

6.3.14.5.b Calculate the times of day at which the contents of the high order scalar will be at the following times.

2.91
5.82
8.73
11.64
14.55
17.46
20.37
23.30

6.3.14.6 If the time of day is within 12 minutes of any of those times calculated in 6.3.14.5.b when about to complete step 6.3.14.30 wait until that time has passed and then proceed.

6.3.14.7 On K-148 enter:

```
VERB 01  NOUN 01  ENTR
00370             ENTR
Record contents of DSKY Row 1 xxxxY
VERB 21  NOUN 01  ENTR
000370            ENTR
XXXXY'            ENTR
Where Y' is obtained from Table 1a.
VERB 57           ENTR
00003             ENTR
```

6.3.14.8 Verify CRT DSKY display as:

VERB 06 NOUN 61 (Flashing)
R1 = +13500 (SM Azimuth)
R1 = +40.748 (Site Latitude)

NOTE: If R1 and R2 indications are correct proceed to step 6.3.14.10.

6.3.14.9 On K-148 enter:

VERB 21 ENTR
+13500 ENTR
VERB 22 ENTR
+40748 ENTR

6.3.14.10 On K-148 enter:

VERB 33 ENTR
Observe on CRT DSKY display
VERB 21 NOUN 30 (Flashing)

6.3.14.11 On K-148 enter:

0000X ENTR (Test position, either 1 or 2)
00000 ENTR (Use AOT)
Observe on CRT DSKY display:
VERB 06 NOUN 61 (Flashing)
Disregard Row 1, 2, and 3 indications

6.3.14.12 On K-148 enter:

VERB 21 ENTR
+XXX.XX ENTR (L tgt. true azimuth from 6.3.15.1.14)
VERB 22 ENTR
+XXX.XX ENTR (L tgt. elevation from 6.3.15.1.3)
VERB 23 ENTR
00001 ENTR (L tgt. number)
VERB 33 ENTR

Observe on CRT DSKY display:

VERB 06 NOUN 61 (Flashing)

Disregard Row 1, 2 and 3 indications.

6.3.14.13 On K-148 enter:

VERB 21 ENTR
+XXX.XX ENTR (F tgt. true azimuth from 6.3.15.1.14)
VERB 22 ENTR
+XXX.XX ENTR (F tgt. elevation from 6.3.15.1.12)
VERB 23 ENTR
00002 ENTR (F tgt. number)
VERB 33 ENTR

Observe on CRT DSKY display:
VERB 51 (flashing)
R1 = 00001

6.3.14.14 On Computer Control and Reticle Dimmer Assembly, press MARK X pushbutton. Observe on DSKY display:

VERB 21 NOUN 30 (Flashing)

6.3.14.15 On DSKY press ENTR

Observe on DSKY display:

VERB 21 NOUN 43 (Flashing)

6.3.14.16 On DSKY enter:

00001 ENTR (L Detent Code)
Observe on DSKY display
VERB 21 NOUN 42 (Flashing)

6.3.14.17 Set AOT to "L" position

6.3.14.18 Rotate AOT control knob until the center of the L tgt reticle is super imposed between the double Y reticle. Record AOT counter value as LY XXX.XX.

6.3.14.19 Rotate AOT control knob until the center of the L tgt reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as LS XXX.XX.

6.3.14.20 On DSKY enter:

±XXX.XX ENTR (value of LY)
Observe on DSKY display:
VERB 22 NOUN 42 (Flashing)

6.3.14.21 On DSKY enter:

±XXX.XX ENTR (Value of LS)
Observe on DSKY display:
VERB 51 (Flashing)
R1 = 00002

6.3.14.22 On Computer Control and Reticle Dimmer Assembly, press MARK X pushbutton. Observe on DSKY display:

VERB 21 NOUN 30 (Flashing)

6.3.14.23 On DSKY press ENTR. Observe on DSKY display:

VERB 21 NOUN 43 (Flashing)

6.3.14.24 On DSKY enter:

00002 ENTR (F Detent Code)
Observe on DSKY display:
VERB 21 NOUN 42 (Flashing)

6.3.14.25 Set AOT to "F" position.

6.3.14.26 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double Y reticle. Record AOT counter value as FY XXX.XX.

6.3.14.27 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as FS XXX.XX.

6.3.14.28 On DSKY enter:

±XXX.XX ENTR (value of FY)
Observe on DSKY display:
VERB 22 NOUN 42 (Flashing)

6.3.14.29 On DSKY enter:

±XXX.XX ENTR (value of FS)

NOTE: Wait until DSKY display indicates VERB 51 (Flashing) R1 = 00001 before proceeding.

NOTE: Before completing step 6.3.14.30 check time of day to verify that the high order scalar will not overflow within the next 12 minutes.

6.3.14.30 Repeat steps 6.3.14.14 through 6.3.14.29.

6

6.3.14.31 In approximately 7 minutes, observe on CRT DSKY display and record.

VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Where number part of Y_{sm} misalignment about Z_{sm})
R2 = .XXXXX (Fractional number part of Y_{sm} misalignment about Z_{sm}.)

6.3.14.32 On K-148 enter.

VERB 33 ENTR
Observe on CRT DSKY display and record:
VERB 06 NOUN 66 (Flashing)

R1 = XXXXX (Whole number part of Z_{sm} misalignment about Y_{sm})
R2 = .XXXXX (Fractional number part of Z_{sm} misalignment about Y_{sm})

6.3.14.33 On K-148 enter:

VERB 36 ENTR
Press ERROR RESET

6.3.14.34 Repeat steps 6.3.14.7 through 6.3.14.30.

6.3.14.35 In approximately 7 minutes, observe on CRT DSKY display and record:

VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Whole number part of X_{sm} misalignment about Y_{sm})
R2 = .XXXXX (Fractional number part of X_{sm} misaligament about Y_{sm})

6.3.14.36 On K-148 enter:

VERB 33 ENTR
Observe on CRT DSKY display and record:
VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Whole number part of Y_{sm} misalignment about X_{sm})
R2 = .XXXXX (Fractional number part of Y_{sm} misalignment about X_{sm})

6.3.14.37 On K-148 enter:

VERB 36 ENTR
Press ERROR RESET
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.14.38 Results. The PIPA bias determined previously in the IMU Performance Test (6.3.9) must be subtracted from the resultant data of the test. The PIPA bias terms from paragraph 6.3.9 must be multiplied by a factor of 210 before performing the calculations in paragraphs 6.3.14.38.1 thru 6.3.14.38.4.

6.3.14.38.1 Y PIPA misalignment

R1 R2
About Z axis (from 6.3.14.31) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Y PIPA bias (from 6.3.9) = −(±XXXXX. XXXXX) $\widehat{\text{sec}}$
Y PIPA misalignment about Z axis = _____ . _____ $\widehat{\text{sec}}$
This value shall not exceed ±600 $\widehat{\text{sec}}$

6.3.14.38.2 Z PIPA misalignment

R1 R2
About Y axis (from 6.3.14.32) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Z PIPA bias (from 6.3.9) = −(±XXXXX. XXXXX) $\widehat{\text{sec}}$
Z PIPA misalignment about Y axis = ±_____ . _____ $\widehat{\text{sec}}$
This value shall not exceed ±600 $\widehat{\text{sec}}$

6.3.14.38.3 X PIPA misalignment

R1 R2
About Y axis (from 6.3.14.35) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less X PIPA bias from (6.3.9) = −(±XXXXX. XXXXX) $\widehat{\text{sec}}$
X PIPA misalignment about Y axis = ±_____ . _____ $\widehat{\text{sec}}$
This value shall not exceed ±600 $\widehat{\text{sec}}$

6.3.14.38.4 Y PIPA misalignment

R1 R2
About X axis from (6.3.14.36) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Y PIPA bias (from 6.3.9) = −(±XXXXX. XXXXX) $\widehat{\text{sec}}$
Y PIPA misalignment about X axis = ±_____ . _____ $\widehat{\text{sec}}$
This value shall not exceed ±600 $\widehat{\text{sec}}$

6.3.15 AOT Functional Accuracy Test.

NOTE: Use of a Dioptometer is required when sighting through AOT. The included angles between target LOS shall be known to ±10 arc seconds. The elevation of each target LOS shall be known to ±15 arc seconds.

6.3.15.1 Insure that G&N System is in the Operate Mode.

6.3.15.2 On K-148 enter:

VERB 21	NOUN 03	ENTR
01462		ENTR
XXX.XX		ENTR (Detent L az data)
		ENTR
01463		ENTR
XXX.XX		ENTR (Detent F az data)
		ENTR
01464		ENTR
XXX.XX		ENTR (Detent R az data)
		ENTR
01465		ENTR
XXX.XX		ENTR (Detent L EL data)
		ENTR
01466		ENTR
XXX.XX		ENTR (Detent F EL data)
		ENTR
01467		ENTR
XXX.XX		ENTR (Detent R EL data)

6.3.15.3 Place the AOT in F detent position.

6.3.15.4 While viewing through the AOT instruct the target F operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target F until the center of the target reticle appears in the center of the AOT reticle.

6.3.15.5 Level the Theodolite base while assuring that the center of the target reticle remains in the center of the AOT reticle.

6.3.15.6 When it has been assured that the Theodolite is level and the target reticle appears in the center of the AOT reticle zero the F theodolite azimuth dial.

6.3.15.7 Place the AOT in the L detent position.

6.3.15.8 While viewing through AOT instruct the target L operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target L until the target reticle appears in the lower right quadrant of the AOT field of view.

6.3.15.9 Level the Theodolite base while assuring that the target reticle remains visible in the lower right quadrant of the AOT field of view.

6.3.15.10 When it has been assured that the Theodolite is level and the target reticle is visible, zero the L Theodolite azimuth dial.

6.3.15.11 Place the AOT in the R detent position.

6.3.15.12 While viewing through AOT instruct the target R operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target R until the target reticle appears in the lower left quadrant of the AOT field of view.

6.3.15.13 Level the Theodolite base while assuring that the target reticle remains visible in the lower left quadrant of the AOT field of view.

6.3.15.14 When it has been assured that the Theodolite is level and the target reticle is visible, zero the R theodolite azimuth dial.

6.3.15.15 Verify that target Theodolite L, F and R bases are level. Place the AOT in each Detent position from left to right and verify that each target reticle is still visible and in the proper field of view. If adjustments are required insure that the azimuth dial is rezeroed. Repeat this target scanning process until the AOT operator is satisfied with target placement.

6.3.15.16 AOT Measurement of X_1.

6.3.15.16.1 On K-148 enter:

VERB 57	ENTR
00012	ENTR

Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display.

6.3.15.16.2 On Computer Control and Reticle Dimming Assembly press MARK X pushbutton.

6.3.15.16.3 Observe VERB 21 NOUN 30 flashing on DSKY.

6.3.15.16.4 On DSKY enter:

00000		ENTR
Observe	VERB 21	NOUN 43 flashing
00001		ENTR
Observe	VERB 21	NOUN 42 flashing

6.3.15.16.5 Set AOT in L detent position.

6.3.15.16.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record as LY = XXX.XX.

6.3.15.16.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPRIAL lines of AOT reticle. Record AOT dial indication as LS XXX.XX.

6.3.15.16.8 Record target L Theodolite elevation angle from horizontal as ϕ_1.

6.3.15.16.9 On DSKY enter:

±XXX.XX		ENTR (LY from 6.3.15.16.6)
Observe	VERB 22	NOUN 42 flashing
±XXX.XX		ENTR (LS from 6.3.15.16.7)
Observe	VERB 51 flashing and R1 = 00002.	

6.3.15.16.10 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton.

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6.3.15.16.11 Observe VERB 21 NOUN 30 flashing on DSKY.

6.3.15.16.12 On DSKY enter:

00000		ENTR
Observe	VERB 21,	NOUN 43 flashing
00002		ENTR
Observe	VERB 21,	NOUN 42 flashing

6.3.15.16.13 Set AOT in F detent position.

6.3.15.16.14 Rotate AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Record AOT dial indication as FY = XXX.XX.

6.3.15.16.15 Rotate the AOT control knob until the center of the target reticle is superimposed between the double S reticle lines. Record AOT dial indication as FS = XXX.XX.

6.3.15.16.16 Record target F Theodolite elevation angle from horizontal as ϕ_2.

6.3.15.16.17 On DSKY enter:

±XXX.XX		ENTR (FY from 6.3.15.16.14)
Observe	VERB 22	NOUN 42 flashing
±XXX.XX		ENTR (FS from 6.3.15.16.15)
Observe	VERB 06	NOUN 03 displayed
Record R1		

6.3.15.17 AOT Measurement of X2.

6.3.15.17.1 On K-148 enter:

VERB 57		ENTR
00012		ENTR
Observe	VERB 51 flashing and R1 = 00001 on CRT DSKY display.	

6.3.15.17.2 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton.

6.3.15.17.3 Observe VERB 21 NOUN 30 flashing on DSKY.

6.3.15.17.4 On DSKY enter:

00000 ENTR
Observe VERB 21 NOUN 43 flashing
00001 ENTR
Observe VERB 21 NOUN 42 flashing
±XXX.XX ENTR (LY from 6.3.15.16.6)
Observe VERB 22 NOUN 42 flashing
±XXX.XX ENTR (LS from 6.3.15.16.7)
Observe VERB 51 flashing and R1 = 00002.

6.3.15.17.5 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton.

6.3.15.17.6 Observe VERB 21, NOUN 30 flashing on DSKY.

6.3.15.17.7 On DSKY enter:

00000 ENTR
Observe VERB 21 NOUN 43 flashing
00003 ENTR
Observe VERB 21 NOUN 42 flashing

6.3.15.17.8 Set AOT in R detent position.

6.3.15.17.9 Rotate AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Record AOT dial indication as RY = XXX.XX.

6.3.15.17.10 Rotate AOT control knob until the center of the target reticle is superimposed between the double SPIRAL reticle lines. Record AOT dial indication as RS = XXX.XX.

6.3.15.17.11 Record target R theodolite elevation angle from horizontal as ϕ_3.

6.3.15.17.12 On DSKY enter:

±XXX.XX ENTR (RY from 6.3.15.17.9)
Observe VERB 22 NOUN 42 flashing
±XXX.XX ENTR (RS from 6.3.15.17.10)
Observe VERB 06 NOUN 03 displayed
Record R1.

6.3.15.18 Theodolite measurement of X_1 and X_2.

6.3.15.18.1 Collimate Theodolite L and F. Read azimuth angle indicated by L Theodolite. Subtract angle from 360.00° and record as $\measuredangle_1$. Read and record the azimuth angle indicated by F Theodolite as $\measuredangle_2$.

6.3.15.18.2 Collimate Theodolite L and R. Read azimuth angle indicated by R Theodolite and record as α_3. Read and record the azimuth angle indicated by L Theodolite. Subtract angle from 360° and record as α'_1.

6.3.15.18.3 Calculate the values of the included angles between target L and F as X_1 and targets L and R as X_2.

$$X_1 = \mathrm{Cos}^{-1} \left\{ \sin \phi_1 \,\mathrm{Sin}\, \phi_2 + \mathrm{Cos}\, \phi_1 \,\mathrm{Cos}\, \phi_2 \,\mathrm{Cos}\, [(180 - (\alpha_1 + \alpha_2)] \right\}$$

$$X_2 = \mathrm{Cos}^{-1} \left\{ \sin \phi_1 \,\mathrm{Sin}\, \phi_3 + \mathrm{Cos}\, \phi_1 \,\mathrm{Cos}\, \phi_3 \,\mathrm{Cos}\, [(180 - (\alpha_3 + \alpha'_1)] \right\}$$

6.3.15.19 The angle recorded in 6.3.15.16.17 shall equal X_1 ±0.08°.

6.3.15.20 The angle recorded in 6.3.15.17.12 shall equal X_2 ±0.08°.

APPENDIX I

MEASUREMENT TOLERANCES

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY 1% OF FULL SCALE
GG 1020 link 4*	+14 vdc LGC Supply	14.0±0.4 vdc	0%
GG 1030 link 4	+4 vdc LGC Supply	4.0±0.2 vdc	0%
GG 1040 link 5**	+120 vdc PIPA Supply	120±6.0 vdc	1%
GG 1070 link 4	+4 vdc CDU Supply	4.0±0.2 vdc	0%
GG 1100 link 4	-28 vdc Supply	-27.5±6.0 vdc	0%
GG 1110 link 5	2.5 vdc Telemetry Bias No. 1	2.5±0.1 vdc	0%
GG 1201 link 5	IMU 28V 800 cps 1%	28±0.56V rms	1%
GG 1202 link 4	IMU 28V 800 cps 5%	28±1.4V rms	1.5%
GG 1203 link 4	IMU 28V 800 cps 5%	28±2.1V rms	1.5%
GG 1331 link 5	3.2 kc 28V Supply 1%	28.6±0.56V rms	1%
GG 1500 link 4	+28 vdc IMU Oper BUS	28.0 -3.5, +5.5 vdc	0%
GG 1510 link 4	+28 vdc IMU STBY BUS	28.0 -3.5, +5.5 vdc	0%
GG 1513X link 5	+28 vdc IMU STBY/OFF	28.0±1 vdc	0%
GG 1520 link 4	+28 vdc LGC Oper BUS	28.0 +4.5, -3.5 vdc	0%
GG 1523X link 5	+28 vdc LGC Operate	28.0±1 vdc	0%
GG 2001 link 5	X PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2021 link 5	Y PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2041 link 5	Z PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2106 link 4	IG Servo Error Total	0.0±60 MV rms at null	1%
GG 2107 link 5	IG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2110 link 4	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2110 link 5	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2112 link 5	IG 1X Resolver Out-Sine	18.4±1.84V rms at 45°	2.5%
GG 2113 link 5	IG 1X Resolver Out-Cosine	18.4±1.84V rms at 45°	2.5%
GG 2121 link 5	IG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2136 link 4	MG Servo Error Total	0.0±60 MV rms at null	1%
GG 2137 link 5	MG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2140 link 4	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2140 link 5	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2142 link 5	MG 1X Resolver Out-Sine	18.4±1.84V rms at 45°	2.5%
GG 2143 link 5	MG 1X Resolver Out-Cosine	18.4±1.84V rms at 45°	2.5%
GG 2151 link 5	MG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2166 link 4	OG Servo Error Total	0.0±60 MV rms at null	1%
GG 2167 link 5	OG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2170 link 4	OG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
NG 1336 link 4	PH DIFF 3.2kc 28V/LGC SYNC	0° ±10°	3%

APPENDIX I (Continued)

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY % OF FULL SCALE
GG 2170 link 5	OG Torque Motor Current	0.9 AMP Max during any fine Align Torque	1%
GG 2172 link 5	OG 1X Resolver Out-Sine	18.4±1.84V rms at 45°	2.5%
GG 2173 link 5	OG 1X Resolver Out-Cosine	18.4±1.84V rms at 45°	2.5%
GG 2181 link 5	OG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2219 link 5	Pitch Attitude Error	5.05±0.5V rms at 17°	1%
GG 2220 link 4	IG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2221 link 4	IG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2249 link 5	YAW Attitude Error	5.05±0.5V rms at 17°	1%
GG 2250 link 4	MG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2251 link 4	MG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2279 link 5	Roll Attitude Error	5.05±0.5V rms at 17°	1%
GG 2280 link 4	OG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2281 link 4	OG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2300 link 5	PIPA Temperature	130.5±1.5°F in Operate	1%
GG 2301 link 4	IRIG Temperature	135±2.5°F in Operate	1%
GG 2301 link 5	IRIG Temperature	135±2.5°F in Operate	1%
GG 2302 link 4	IMU Heater Current On	28±1 vdc	0%
GG 2303 link 4	IMU Blower Current On	28±1 vdc	0%
GG 3304 link 5	RR Shaft 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3305 link 5	RR Shaft 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 3311 link 4	RR Shaft CDU Fine Error	0.0±0.07V rms at null	1%
GG 3312 link 4	RR Shaft CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3321 link 4	RR Trunnion CDU Fine Error	0.0±0.07V rms at null	1%
GG 3322 link 4	RR Trunnion CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3324 link 5	RR Trunnion 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3325 link 5	RR Trunnion 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 4300 link 4	LGC Temperature	87.5±42.5°F	0%
GG 6020 link 4	PIPA Calibration Module Temperature	67,5±22.5°F	0%
GG 6020 link 5	PIPA Calibration Module Temperature	67.5±22.5°F	0%
GG 6021 link 4	PSA Temperature	85±25.0°F	0%

~~*Link 4 — PSA [illegible]~~

~~**Link 5 — SCA [illegible]~~

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY OF FULL SCALE
NG1021 Link 4	14 VDC LGC Noise RMS	0.4 VRMS Max	0%
NG1022 link 4	14 VDC LGC Noise Peak	5 volts with rise time of 2 to 5 usec	0%
NG1031 link 4	4 VDC LGC Noise RMS	0.4 VRMS Max	0%
NG1032 link 4	4 VDC LGC Noise Peak	5 volts with rise time of 2 to 50 used	0%
NG1071 link 4	4 VDC CDU Noise RMS	1.0 VRMS Max	0%
NG1072 link 4	4 VDC CDU Noise Peak	5 volts with rise time of 2 to 50 usec	0%
NG1501 link 4	28 VDC IMU Operate Noise RMS	1.0 VRMS Max	0%
NG1502 link 4	28 VDC IMU Operate Noise Peak	5 volts with rise time of 2 to 50 usec	0%
NG1511 link 4	28 VDC IMU Standby Noise RMS	1.0 VRMS Max	0%
NG1512 link 4	28 VDC IMU Standby Noise Peak	5 volts with rise time of 2 to 50 usec	0%
NG1521 link 4	28 VDC LGC Operate Noise RMS	2.0 VRMS Max	0%
NG1522 link 4	28 VDC LGC Operate Noise Peak	5 volts with rise time of 2 to 50 usec	0%

*Link 4 - PSAAM Output Signal

**Link 5 - SCA Output Signal

ADDENDUM 1

LEM 1

ADDITION 1: The following procedure will be performed for LEM 1 only.

6.3.16 Gyrocompassing Test

6.3.16.1 Insure that the IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.16.2 On K-148 enter the following sequence:

VERB 57 ENTR
00006 ENTR

6.3.16.3 VERB 06 NOUN 61 shall flash.

6.3.16.4 The CRT, DSKY display shall display Launch Azimuth. (Launch Azimuth shall be the GAEC Navigator Base Azimuth defined by GAEC).

6.3.16.5 If value for Row 1 is correct, proceed to the next step. If value for Row 1 is incorrect, enter the following into K-148:

VERB 21 ENTR
±XXXXX ENTR Correct launch azimuth (GAEC Nav Base Az)

Verify value in Row 1 is correct.

6.3.16.6 On K-148 enter the following:

VERB 33 ENTR

6.3.16.7 VERB 06 NOUN 61 shall flash.

6.3.16.8 The CRT, DSKY display shall display Navigation Base Azimuth and Latitude, respectively.

6.3.16.9 If the values for Row 1 and Row 2 are correct, proceed to the next step. If the values for Row 1 or Row 2 are incorrect, enter the following into K-148.

If Row 1 is incorrect: VERB 21 ENTR
±XXXXX ENTR (Correct Nav Base Azimuth)

If Row 2 is incorrect: VERB 22 ENTR
+40.748 ENTR (Correct Site Latitude)

Verify values for Row 1 and Row 2 are correct.

6.3.16.10 On K-148 enter the following:

VERB 33 ENTR
VERB 16 NOUN 20 ENTR

6.3.16.11 One hour after step 6.3.16.10 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.16.12 Obtain and record the latest measured value of the following data.

6.3.16.12.1 NBDX

6.3.16.12.2 NBDY

6.3.16.12.3 NBDZ

6.3.16.12.4 ADIAZ

6.3.16.12.5 ADSRAY

6.3.16.12.6 GAEC NB YZ plane about Z local vertical.

6.3.16.12.7 GAEC NB YZ plane about Y local vertical.

6.3.16.13 Calculate the vertical and east IRIG coefficient drift contribution to azimuth error (ϕ Vert).

a. Drift (vert) = NBDZ+ADIAZ = ________________ meru

b. Drift (east) = NBDX sin α +NBDY sin (α + 90) + ADSRAY sin (α + 90)
Where α = Launch Azimuth

c. ϕ vert = $\frac{6.65a + 272b}{3600}$ = ____________ degrees

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6.3.16.14 Algebraically subtract φ (vert) from the Row 1 DSKY display recorded in 6.3.16.11. The resultant azimuth error shall be 000.00±000.57 degrees.

6.3.16.15 Algebraically subtract the value recorded in 6.3.16.12.6 from the Row 3 DSKY display recorded in 6.3.16.11. The resultant vertical error about Z local vertical shall be 000.00±000.06 degrees.

6.3.16.16 Algebraically subtract the value recorded in 6.3.16.12.7 from the Row 2 DSKY display recorded in 6.3.16.11. The resultant vertical error about Y local vertical shall be 000.00±000.06 degrees.

6.3.16.17 Two hours after 6.3.16.10 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.16.18 The CRT DSKY display of Row 1 shall be within 000.06 degrees of the value recorded in 6.3.16.11. The CRT DSKY display of Row 2 and Row 3 shall be within 000.03 degrees of the respective values recorded in 6.3.16.11.

6.3.16.19 On K-148 enter the following:

VERB 36		ENTR
VERB 40	NOUN 20	ENTR
+00000		ENTR
+00000		ENTR
+00000		ENTR

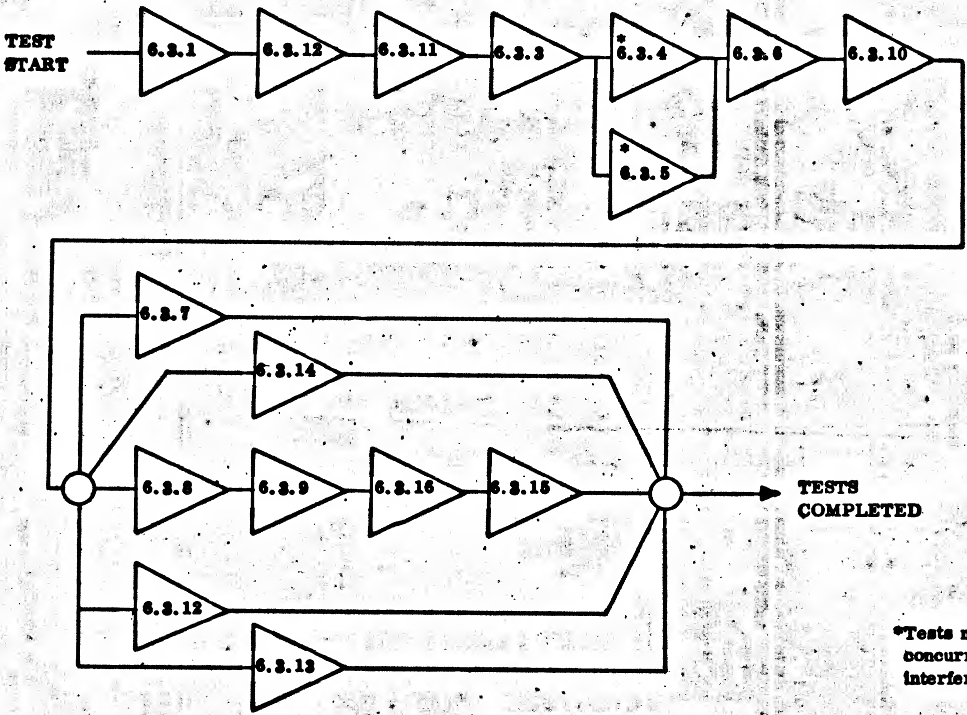
ADDENDUM 1

LEM 1

Addition 2: Perform LEM 1 test in accordance with the following Flowgram.

Addition 3: Place a note after paragraph 6.3.1.6.2.

NOTE: If the LMP Interlock CB is energized insure that the ATCA switch on LEM Panel 16 and the ATCA/PGNCS switch on Panel 11 are in the off position before performing the following steps.



*Tests may be performed concurrently on a non-interference basis

TEST PROCEDURE FLOWGRAM

FIGURE 1

ADDENDUM II
AURORA 85

Following are the changes required to make this document applicable for checkout of a G&N System with an Aurora 85 Test Rope.

Addition 1. Paragraph 6.3.7 PGNCS Operational Test

a. Delete paragraphs 6.3.7.15.2 and 6.3.7.15.3

b. Subtract an Octal 1 from each of the NOUN display requirements in paragraphs 6.3.7.20.1, 6.3.7.20.3, 6.3.7.20.5, 6.3.7.20.7, 6.3.7.20.9, 6.3.7.20.11 and 6.3.7.20.13.

Addition 2. Paragraph 6.3.8 IRIG Scale Factor Test

a. Change Paragraph 6.3.8.22 to read as follows:

The average of the three readings of Scale Factor Error for each of the 6 positions shall be 556±1750 PPM.

Addition 3. Paragraph 6.3.9 IMU Performance Test.

a. Add the following note prior to step 6.3.9.22.

NOTE: Paragraph 6.3.9.24 must be performed within one minute after VERB 06 and NOUN 66 flash in paragraph 6.3.9.23. In the event a PROG alarm is obtained enter VERB 36, press the ENTR pushbutton and repeat paragraphs 6.3.9.8 through 6.3.9.24.

b. Add the following note prior to step 6.3.9.36.

NOTE: Paragraph 6.3.9.39 must be performed within one minute after VERB 06 and NOUN 66 flash in paragraph 6.3.9.38. In the event a PROG alarm is obtained enter VERB 36, press ENTR and repeat paragraphs 6.3.9.8 through 6.3.9.1. Enter the following in K-148.

VERB 25	ENTR
+00600	ENTR
+00000	ENTR
+00003	ENTR

Repeat paragraphs 6.3.9.28 through 6.3.9.39.

6.3.17.4.4 On K-148 enter the following:

Press ERR RST
VERB 36 ENTR
VERB 41 NOUN 40 ENTR
+00000 ENTR
+03375 ENTR
VERB 34 ENTR
VERB 21 NOUN 10 ENTR
00012 ENTR
00001 ENTR

Verify RR CDU Fail comes ON in approximately 90 seconds.

ADDENDUM III RR INTERFACE

LTA-8, (MSC) - LEM 2 & Subsequent

RR CDU testing requires that the Rendezvous Radar is operating. The Rendezvous Radar is not activated until Integrated testing. To insure that the RR CDU's are operating properly the minimum requirements for RR CDU testing are presented here so that they may be included as part of the requirements to be demonstrated at the first opportunity after Rendezvous Radar activation.

6.3.17 RR/CDU Control

6.3.17.1 Command Accuracy 24000°

6.3.17.1.1 On K-148 enter the following

VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+24000		ENTR
+24000		ENTR
VERB 34		ENTR

The CRT RR CDU Trunnion and Shaft angle indications shall be 240.00±000.30°.

6.3.17.2 CDU Fine and CDU Coarse Error

6.3.17.2.1 Set up analog recorder to monitor the following:

Meas. No.	Signal Name
a. GG3311	Shaft CDU Fine Error
b. GG3312	Shaft CDU Coarse Error
c. GG3321	Trunnion CDU Fine Error
d. GG3322	Trunnion CDU Coarse Error

6.3.17.2.2 On K-148 enter the following:

VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+04500		ENTR
+04500		ENTR
VERB 34		ENTR

6.3.17.2.3 Verify the following signals on the CRT.

RR Shaft 1X Sin (GG3304)	18.4±1.84 VRMS
RR Shaft 1X Cos (GG3305)	18.4±1.84 VRMS
RR Trunnion 1X Sine (GG3324)	18.4±1.84 VRMS
RR Trunnion 1X Cos (GG3325)	18.4±1.84 VRMS

6.3.17.2.4 Verify that no CDU Fine Error (GG3311, GG3321) exceeds .070 volts.

6.3.17.2.5 Verify that no CDU Coarse Error (GG3312, GG3322) exceeds .600 volts.

6.3.17.3 Deleted. stability

6.3.17.3.1 Deleted. the CRT RR Shaft and Trunnion CDU indications.

6.3.17.3.2 * Deleted. nd enter the following:

VERB 40 NOUN 40 ENTR

Wait 10 seconds then record the CRT RR CDU Trunnion and Shaft indications; the recorded value shall be within ±000.01° of the value recorded above.

6.3.17.4 RR CDU Fail

6.3.17.4.1 On K-148 Enter the following:

VERB 36 ENTR
VERB 41 NOUN 40 ENTR
+00100 ENTR
+00000 ENTR
VERB 34 ENTR
VERB 21 NOUN 10 ENTR
00012 ENTR
00001 ENTR

Verify RR CDU Fail comes ON in approximately 10 seconds.

6.3.17.4.2 On K-148 enter the following:

Press ERR RST
VERB 36 ENTR
VERB 41 NOUN 40 ENTR
+00000 ENTR
+00100 ENTR
VERB 34 ENTR
VERB 21 NOUN 10 ENTR
00012 ENTR
00001 ENTR

Verify RR CDU Fail comes ON in approximately 10 seconds.

6.3.17.4.3 On K-148 enter the following:

Press ERR RST		
VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+03375		ENTR
+00000		ENTR
VERB 34		ENTR
VERB 21	NOUN 10	ENTR
00012		ENTR
00001		ENTR

Verify RR CDU Fail comes ON in approximately 10 seconds.

6.3.17.4.4 On K-148 enter the following:

Press ERR RST		
VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+00000		ENTR
+03375		ENTR
VERB 34		ENTR
VERB 21	NOUN 10	ENTR
00012		ENTR
00001		ENTR

Verify RR CDU Fail comes ON in approximately 10 seconds.

6.3.17.4.5 On K-148 enter the following:

Press ERR RST		
VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+00000		ENTR
+00000		ENTR
VERB 34		ENTR

APOLLO G&N Specification
ND 1002323 REV ~~D~~ G

Original Issue Date:
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POST-INSTALLATION CHECKOUT SPECIFICATION
FOR LM G&N SYSTEM

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	APPROVALS AC	APPROVALS NASA
11/23/66	A	32056	1-83 Was 83 pages, now 80 pages.	EA	WLS
12/29/66	B	32480	6-46, 51, 62, 67, 73, 74, 78 R06/ac	JP	- -
2/27/67	C	33084	5-86 R04/ac	EA	--
4/17/67	D	33613	3, 6, 7, 16, 17, 18, 22, 23, 28, 35,		
			44, 45, 64, 79, 85 R06/ac	EA	WLS
7/27/67	E	34218	3, 5-7, 9-12, 14, 16-86; was 86 pages	EA	--
			now 94 pages. JK/AC		
11/2/67	F	35010	6-94; was 94 pages, now 95 pages.	EA	--
1/12/68	G	35420	67	EA	--

This specification consists of page 1 to 96 inclusive.

APPROVALS	NASA/MSC				9/13/66

6.3.12.4 Test Analysis

6.3.12.4.1 Remove the strip charts from analog recorders

6.3.12.4.2 Examine each trace carefully to detect any sharp discontinuities of the traces. Disregard all transients less than 0.5 second (5 mm) on any Torque Motor Current signal. Disregard all transients less than 0.2 second (2 mm) on any CDU Fine Error signal.

6.3.12.4.3 No Torque Motor Current signal on (GG2140, GG2170, GG2110) shall ever exceed (0.125) amp. Sensitivity on recorder is 20 ma/division for GG2110, GG2140 and 36 ma/division for GG2170.

6.3.12.4.4 Each CDU Fine Error (GG2220, GG2280, GG2250) shall not exceed .070 volts steady state. Disregard transients.

6.3.12.4.5 No CDU Coarse Error (GG2221, GG2281, GG2251) shall ever exceed 0.680 volts.

6.3.13 Stabilization Loop Step Response Test

6.3.13.1 IG Response Test

6.3.13.1.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+00000	ENTR		

6.3.13.1.2 On CRT, verify IG MG, and OG gimbal angles are between 358 and 002.

6.3.13.1.3 Set up analog recorder to monitor the following:

MEAS NO.	SIGNAL NAME
a. GG2110	IG Torque Motor Current
b. GG2106	IG Servo Error Total
c. GG2107	IG Servo Error In Phase
d. GG2112	IG 1X resolver Sine
e. GG2113	IG 1X Resolver Cosine
f. GG2220	IG CDU Fine Error
g. GG1201	IMU 28V 1 PCT 800 CPS

6.3.13.1.4 On K-148 initiate FINE ALIGN by entering the following sequence:

VERB 42	ENTR
+00000	ENTR
+00000	ENTR
+00000	ENTR

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POST-INSTALLATION CHECKOUT SPECIFICATION
FOR LM G&N SYSTEM

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	APPROVALS	
				AC	NASA
11/22/66	A	32056	1-83 Was 83 pages, now 80 pages.	EA	WLS
12/29/66	B	32480	6-46, 51, 62, 67, 73, 74, 78 RO6/ac	JP	- -
2/27/67	C	33084	5-86 RO6/ac	EA	—
4/17/67	D	33613	3, 6, 7, 16, 17, 18, 22, 23, 28, 35,		
			44, 45, 64, 79, 85 RO6/ac	EA	WLS
7/27/67	E	34218	3, 5-7, 9-12, 14, 16-86; was 86 pages	EA	—
			now 94 pages. JH/AC		
11/2/67	F	35010	6-94; was 94 pages, now 95 pages.	EA	—
1/12/68	G	35420	67	EA	--
2/28/68	H	35774	3, 5, 6, 11-14, 17-21, 24, 25, 28-95; was 95 pages, now 100 pages.	EA	WLS

This specification consists of page 1 to 100 inclusive.

APPROVALS				
	NASA/MSC			9/13/68

5.2.2 The PSA, CDU, and PTA cold plates shall be provided with coolant as per ICD LIS-510-10001.

5.3 TEST EQUIPMENT TOLERANCES

5.3.1 Measurement and tolerance specifications stated herein are basic G&N system performance specifications. Calibration data must be supplied to the Acceptanse Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. PSAAM and signal conditioner stability uncertainties are included in Appendix I.

5.3.2 In the event of a conflict between requirements, the following order of precedence shall apply. The contractor shall also notify AC Electronics Site Manager of the conflict.

a. The contract
b. This specification
c. Documents referenced in this specification

5.4 TEST SEQUENCE

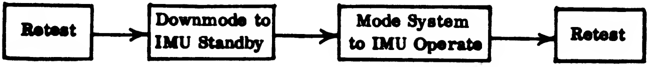
5.4.1 The test sequence shall normally follow the flowgram in Figure 2. Any test subsequent to Temperature Control Verification Section 6.3.4 may be conducted providing the General Turn On Procedure 6.2.4 is followed.

5.5 The generation of a noise alarm indication, as evidenced by one or more Noise Peak Event lamps becoming lighted shall be cause for immediate determination of effects on the G&N system test in progress. In the event of detrimental effects on the system test a troubleshooting routine shall be entered to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.

5.6 TEST FAILURE CRITERIA

5.6.1 IRIG and PIPA data (See paragraph 6.3.9)

5.6.1.1 If D_1, D_2, or D_3 exceeds its maximum value as specified in 6.3.9 for any IRIG or PIPA, a retest sequence shall be initiated as indicated below:



RETEST SEQUENCE

The retest sequence shall be performed using the paragraphs indicated in Table 4 corresponding to the out-of-spec parameters. Table 5 indicates the test positions and other isolated parameters that must be recalculated and qualified.

If D_1, D_2, and D_3 are within tolerance after the retest sequence is completed, the original out-of-tolerance terms calculated in 6.3.9.70.4 shall be exonerated.

5.6.1.2 Failure to be within the maximum values of D_1, D_2, and D_3 after the retest sequence of 5.6.1.1 shall constitute a failure of the assembly.

5.6.2 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N System as non-conforming. Normal test sequence may be continued upon determination of the cause of the nonconformance or at the discretion of the G&N contractor test team if it is determined that such action is not detrimental to the G&N System or other interfacing subsystems. All nonconformances shall be investigated and cleared by waivers (F.N.N.), correction of specification, or hardware replacement and retest. The suspected malfunctioned hardware shall be removed and returned to the laboratory where the malfunction shall be verified. Only after malfunction verification shall a flight certified replaceable element be installed in the G&N System.

5.7 Retest subsequent to replacement of a malfunctioned assembly with that of a flight certified assembly shall be at the discretion of NASA Engineering. Table I can be used as a guide to determine general retest requirements. In all retest procedures, the test sequence of Figure 2 shall be adhered to.

5.8 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps pertaining directly to the G&N components. If any questions arise concerning the test equipment, the Test Conductor should refer to the respective operational manuals.

5.9 Spacecraft systems other than the G&N System may be operating on a noninterfering basis while individual system checkout of the G&N is being conducted.

5.10 DATA RETRIEVAL

5.10.1 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance reading shall be recorded and flagged by appropriate signals.

5.10.2 During G&N system testing, all interleaved data, Uplink Command Files and Downlink Data File shall be maintained (recorders On). All A/B PCM data that is not made available to the ACE displays shall be verified by requesting a time history data strip out of said data for the time period when the test was performed.

5.11 General Operating Characteristics

5.11.1 The DSKY "NO ATT" lamp illuminates any time the system is in the Coarse Align Mode, caging or turn on.

6. DETAILED REQUIREMENTS

6.1 INITIAL TEST CONDITIONS

6.1.1 The IMU shall be supplied with heater power on a continuous basis. The Portable Temperature Controller (Model No. 410-31058) shall be connected at all times although heater power may be supplied from the +28 VDC IMU STANDBY bus and monitored through ACE.

6.1.2 The IMU shall never be without heater power longer than 15 minutes.

6.2 OPERATIONAL REQUIREMENTS

6.2.1 Emergency Shutdown Procedure

CAUTION

In the event of any malfunction which might damage the G&N System before the normal shutdown procedure in 6.2.2 can be performed, power shall be removed from the G&N System as soon as possible. If at all possible, without creating any delay, IMU Operate power should be removed first.

6.2.2 Normal Shutdown Procedure

6.2.2.1 The normal shutdown of a G&N System shall include parking the gimbals prior to removing IMU Operate Power. This is accomplished in the following procedure.

6.2.2.2 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+09000 ENTR

6.2.2.3 On the CRT, verify the following gimbal angles are displayed:

IG is between 358 and 002
MG is between 088 and 092
OG is between 358 and 002
Verify Gimbal Lock Lamp is lighted.

6.2.2.4 Pull out +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11 to remove IMU OPERATE power.

6.2.2.4.1 On K-148, enter the following:

VERB 21 NOUN 01 ENTR
00034 ENTR
00000 ENTR
Verify GIMBAL LOCK lamp is OFF
VERB 21 NOUN 01 ENTR
00322 ENTR
40000 ENTR
Verify NO ATT lamp indication is OFF.

6.2.2.5 Pull out +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11 to remove LGC OPERATE power.

6.2.2.6 Pull out +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11 to remove IMU STANDBY power.

6.2.3 Initial Turn-On Procedure

6.2.3.1 Deleted.

6.2.3.2 The initial power turn-on sequence shall be in the order specified in the test procedures (6.3) observing all cautions and delays as specified.

6.2.4 General Turn-On Procedure

6.2.4.1 This step shall be effective only after having completed the initial turn-on procedures.

6.2.4.2 Proper coolant flow shall be verified.

6.2.4.3 Depress +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11 to supply IMU STANDBY power. Record time.

6.2.4.4 Depress +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11 to supply LGC Operate power. The Restart lamp may come on, if it does press RSET on the DSKY.

6.2.4.6 On K-148 enter the following sequence:

ERROR RESET
VERB 36 ENTR (fresh start)
VERB 21 NOUN 01 ENTR
1362 ENTR (REDO CTR)
00000 ENTR
VERB 21 NOUN 27 ENTR
77777 ENTR (LGC Self Check)

6.2.4.7 On the CRT, verify that the 3.2 KC 28V Supply indicates between 28.04 and 29.16 VRMS (CG 1331).

6.2.4.8 On the CRT, verify that R1 does not display 01102 or 41102 (indicating a malfunction).

6.2.4.9 Wait 5 minutes then enter the following in K-148.

a. VERB 34 ENTR
b. VERB 21 NOUN 27 ENTR
c. 00000 ENTR
d. VERB 25 NOUN 01 ENTR
e. 03770 ENTR SET LOC.
f. 10067 ENTR CSS NEW JOB
g. 04317 ENTR TC CHANG 1
h. 01770 ENTR TC ACTLITON
i. VERB 25 NOUN 26 ENTR CALL PRIO/DELAY
j. 01000 ENTR 01 PRIORITY
k. 01770 ENTR RELATIVE E-MEM
l. 00007 ENTR BANK ADD.
m. VERB 30 ENTR REQ EXEC.

NOTE: If a VERB 36 is performed after the above information has been entered, repeat lines 6.2.4.9.i through 6.2.4.9.m.

6.2.4.10 CAUTION: LGC OPERATE AND IMU STANDBY power must have been applied a minimum of two hours before energizing the IMU OPERATE circuit breaker in step 6.2.4.16 unless all of the following conditions are met:

IF: 1. The G&N System has previously been in Standby Mode at least two hours and subsequently been in Operate Mode, AND

2. The gimbals were placed in a parked position prior to shutdown, AND

3. The shutdown period did not exceed 5 days, AND

4. The Spacecraft or IMU have not been moved in any way during the shutdown period.

THEN: The two-hour standby Mode operation requirement is reduced to 15 minutes.

6.2.4.11 The G&N System is defined as being in Standby Mode when LGC Operate and IMU Standby power is applied and IMU Operate power is off. The inertial components shall have suspension power in Standby Mode.

6.2.4.12 The G&N System is defined as being in Operate Mode when LGC OPERATE, IMU STANDBY and IMU Operate Power is applied to the system.

6.2.4.13 Set up analog recorder to monitor the following signals:

Signal No.	Signal Name
a. GG2136	MG Servo Error Total
b. GG2106	IG Servo Error Total
c. GG2166	OG Servo Error Total
d. GG2112	IG 1X Resolver Sine
e. GG2172	OG 1X Resolver Sine
f. GG2142	MG 1X Resolver Sine
g. GG1201	IMU 28V 1% 800 CPS

6.2.4.14 Deleted analog recorder at a chart speed of 5 mm/sec. Start event recorder at a chart speed of 1 mm/sec.

6.2.4.15 On CRT, monitor +120 VDC PIPA SUPPLY (GG1040) and IMU gimbal angles. Record time. If 15 minutes have elapsed since performing Paragraph 6.2.4.3, proceed to the next paragraph.

6.2.4.16 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.2.4.17 Verify on analog recorder that the oscillations of the resolver sine signals (GG2112, GG2172 and GG2142) are not sustained and that the signals damp out within 15 seconds. If this condition is not attained, remove IMU OPERATE power immediately.

6.2.4.18 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.2.4.16 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.2.4.16.

6.2.4.19 Verify absence of LGC WARNING, ISS WARNING, and PGNCS CAUTION lights in the LEM cabin.

6.2.4.20 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.2.4.21 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.1.3 The following switches and/or circuit breakers shall be closed to energize the indicated buses. On Panel 5 rotate ANUN/NUM dimmer to minimum discernable brightness. On Panel 5 set the LIGHTING OVERRIDE switch to OFF.

LOCATION	NOMENCLATURE	IDENTIFICATION
Panel 14	BAT 5 NORMAL FEED	4S10
Panel 14	BAT 6 NORMAL FEED	4S11
Panel 16	X LUNAR BUS TIE	4CB5
Panel 16	BAT 1-4-6 FEED TIE	4CB17
Panel 16	BAT 2-3-5 FEED TIE	4CB25
Panel 16	ASC ECA	4CB14
Panel 16	ASC ECA CONT.	5CB7
Panel 16	DC BUS VOLT	4CB21
Panel 16	DISP.	4CB16
Panel 11	X LUNAR BUS TIE	4CB4
Panel 11	BAT 1-4-6 FEED TIE	4CB18
Panel 11	BAT 2-3-5 FEED TIE	4CB26
Panel 11	ASC ECA	4CB15
Panel 11	ASC ECA CONT.	4CB6
Panel 11	DC BUS VOLT	4CB22
Panel 11	LTG ANUN/DOCK COMP	4CB146
Panel 16	LTG ANUN/DOCK COMP	4CB148
Panel 16	INV. NO. 2	4CB13
Panel 14	AC PWR to INV 2 Position	4S14
Panel 11	AC BUS FEED TIE	4CB24
Panel 11	AC BUS VOLT	4CB27

6.3.1.4 IMU Standby Power Turn On

6.3.1.4.1 Deleted.

6.3.1.4.2 Press in +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11. Record time.

6.3.1.4.3 Verify on event recorder that +28 VDC IMU STANDBY power discrete (GG1513) is on. On CRT, +28V IMU STANDBY Bus (GG1510) shall indicate between 24.5 and 33.5.

6.3.1.4.4 30 minutes after entering the IMU Standby Mode start recording PIPA TEMP every 5 minutes until the PIPA temperature is stabilized. The PIPA temperature shall be considered stabilized when the temperature change is less than 0.01 degree for 30 minutes. Record the PIPA Standby Mode stabilized temperature.

6.3.1.5 Computer Power Turn On

6.3.1.5.1 Press in +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11. Restart light may be on, verify LGC WARNING OFF and PGNCS CAUTION ON.

6.3.1.5.2 On CRT, +28V LGC Operate Bus (GG1520) shall indicate between 23.5 and 32.5. Ignore computer alarm indications. Using DSKY, enter VERB 36 ENTR then press RSET. All Computer alarms shall clear.

6.3.1.5.3 On CRT, the +14 VDC LGC SUPPLY (GG1020) shall indicate between 13.6 and 14.4 VDC. Record this value.

6.3.1.5.4 On CRT, the +4 VDC LGC SUPPLY (GG1030) shall indicate between 3.8 and 4.2 VDC. Record this value.

6.3.1.5.5 On CRT the 28V 3200 CPS SUPPLY (GG1331) shall indicate between 28.04 and 29.16 vrms. Record this value.

6.3.1.6 LGC Operational Tests

6.3.1.6.1 DSKY Check

6.3.1.6.1.1 Press ERROR RESET by entering in the DSKY:

VERB 21 NOUN 01 ENTR
01362 ENTR (REDO CTR)
00000 ENTR
VERB 21 NOUN 01 ENTR
00011 ENTR

6.3.1.6.1.2 All the electroluminescent elements (PROG, VERB, NOUN, and Row 1, Row 2, Row 3) shall display the decimal number (9). Including the 9's, each of the following shall be displayed for approximately 5 seconds.

a. 9's
b. 8's
c. 7's
d. 6's
e. 5's
f. 4's
g. 3's
h. 2's
i. 1's
j. 0's
k. Minus signs in Row 1, ROW 2, ROW 3
l. VERB-NOUN flashing
m. COMP ACTY

} On concurrently for 5 seconds

o. Plus signs in ROWS 1, 2, and 3
p. VERB-NOUN Flashing
q. COMP ACTY

} On concurrently for 5 seconds

r. COMP ACTY - On for 5 seconds then DSKY blanks.

6.3.1.6.1.3 The DSKY pushbuttons shall be checked by entering:

VERB 25 NOUN 01 ENTR
01740 ENTR
+00123 ENTR
-00456 ENTR
-00789 DO NOT press ENTR

The DSKY shall display +00123 in Row 1, -00456 in Row 2, and -00789 in Row 3. Press CLR pushbutton three times on DSKY. Observe that Row 1, Row 2, and Row 3 are blank.

6.3.1.6.2 Lamp Test

6.3.1.6.2.1 Initiate the Lamp Test by entering in the DSKY:

VERB 35 ENTR

6.3.1.6.2.2 The following DSKY displays shall illuminate for approximately 5 seconds. On CAUTION/WARNING panel, the following displays shall illuminate, then extinguish:

LGC
ISS
PGNS

a. UP LINK ACTY
b. NO ATT
c. STBY
d. KEY REL flashing
e. TEMP
f. GIMBAL LOCK
g. PROG
h. RESTART
i. TRACKER
j. OPR ERROR Flashing
k. VERB-NOUN Flashing
l. Plus 88888 in Row 1, Row 2, and Row 3

On concurrently for approximately 5 seconds.

8's remain in the VERB NOUN display
+8's remain in DSKY Row 1, 2 and 3 display

6.3.1.6.3 Uplink Check

6.3.1.6.3.1 On K-START 148; set LOAD/INHIBIT switch to LOAD, set TAPE/KEY switch to KEY, then enter the following:

ERROR RESET
VERB 25 NOUN 01 ENTR
02400 ENTR
+01234 ENTR
-56789 ENTR
+00000 ENTR

6.3.1.6.3.2 Verify the following is displayed on the DSKY.

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.4 Downlink Check

6.3.1.6.4.1 On CRT, DSKY display, verify the following is displayed:

VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.5 LGC Self-Check

6.3.1.6.5.1 VERB 36 ENTR
VERB 25 NOUN 01 ENTR
1366 ENTR
00000 ENTR
00000 ENTR
00000 ENTR
VERB 15 NOUN 01 ENTR
01366 ENTR

6.3.1.6.5.2 On the CRT, DSKY display, verify that R1 does not display 01102 or 41102. If a malfunction occurs, the following is displayed:

R1 01102 or 41102
R2 XXXXX c (S FAIL) program address +1 of point of failure
R3 XXXXX number of fails.

6.3.1.6.5.3 When R3 = 00002, stop the LGC Self Check by entering in K-148 the following:

VERB 34 ENTR
VERB 21 NOUN 27 ENTR
00000 ENTR

6.3.1.6.6 LGC Standby Check

6.3.1.6.6.1 On K-148, enter the following sequence:

VERB 21 NOUN 17 ENTR
+00000 ENTR

Start ACE Countdown clock upon depressing ENTR from an initial setting of 0 HRS, 0 MIN, 0 SEC. Record difference between LGC time on the CRT and the Countdown clock.

VERB 60 ENTR
Verify on CRT ABL-LGC-STBY is ON

6.3.1.6.6.2 On DSKY depress STBY pushbutton for approximately 3 seconds.

6.3.1.6.6.3 Verify STBY status indicator lamp is ON.

6.3.1.6.6.4 On the CRT, verify the 3.2 KC 28V Supply (GG1331) is between 28.04 and 29.16V RMS.

6.3.1.6.6.5 On DSKY depress STBY pushbutton for approximately 3 seconds to return to LGC OPERATE mode.

6.3.1.6.6.6 Verify STBY status indication lamp is OFF. RESTART light may be ON, verify LGC WARNING OFF and PGNCS CAUTION ON. Press ERROR RESET pushbutton. Enter VERB 61 ENTR on K-148. Verify on CRT ABL-LGC-STBY is OFF. Record LGC time on the CRT and time displayed on the countdown clock simultaneously. Verify that the difference between the LGC time and countdown clock is within one second of the difference recorded in 6.3.1.6.6.1.

6.3.1.6.7 Standby/Proceed Check

6.3.1.6.7.1 On K-148 enter the following:

VERB 11 NOUN 10 ENTR
00032 ENTR

6.3.1.6.7.2 On the DSKY press and hold the STBY pushbutton. Verify Row 1 of the DSKY displays 57777.

6.3.2 Alarms and Interrupts Test

6.3.2.1 Parity Fail Test

6.3.2.1.1 On K-148 enter the following sequence

VERB 21 NOUN 02 ENTR
01600 ENTR
33777 ENTR

6.3.2.1.2 On CRT, DSKY display, verify R1 = 33777 and R3 = 01600

6.3.2.1.3 On K-148 enter the following sequence

VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.1.4 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.1.5 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.2 Rupt Lock-Interrupt Too Long

6.3.2.2.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
00001 ENTR
01600 ENTR
00003 ENTR
VERB 31 ENTR

6.3.3.1.6 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90±10 seconds after step 6.3.3.1.4 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.3.3.1.4.

6.3.3.1.7 On event recorder verify the following:

LGC WARNING is OFF (GG9001)
ISS WARNING is OFF (GG9002)
PGNCS CAUTION is OFF (GG9003)

6.3.3.1.7.1 On DSKY, verify that the NO ATT light is off.

6.3.3.1.8 On CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.3.1.9 On K-148 enter the following sequence:

VERB 41 NOUN 20	ENTR
+00000	ENTR
+00000	ENTR
+00000	ENTR

6.3.4 Temperature Control Verification

6.3.4.1 Monitor the PIPA temperature during the first 15 minutes after switch from Standby Mode to the Operate Mode. The PIPA temperature shall be 130.5±2.0°F, during this period. 15 minutes after switching from Standby Mode to the Operate Mode, record the PIPA temperature. The recorded PIPA temperature shall be within 0.5°F of the Operate stabilized PIPA temperature determined below.

6.3.4.2 When 30 minutes have elapsed from the time of IMU OPERATE power turn-on record IRIG TEMP (GG2301). The IRIG temperature shall be within 0.5°F of the IRIG Operate mode stabilized temperature determined below.

6.3.4.3 30 minutes after entering the IMU OPERATE mode start recording PIPA TEMP every 5 minutes until the PIPA temperature is stabilized. The PIPA temperature shall be considered stabilized when the temperature change is less than 0.1° for 30 minutes. Record the PIPA Operate mode stabilized temperature. The PIPA Operate mode stabilized temperature shall be 130.5±1.5°F. Record the IRIG Operate mode stabilized temperature. The IRIG Operate mode stabilized temperature shall be 135±2.5°F.

6.3.4.4 Deleted.

6.3.4.5 Deleted.

6.3.4.6 Deleted.

6.3.4.7 Verify on the event record the IMU Blower Current (GG2303) and IMU Heater Current (GG 2302) "on" discretes have been present for the last hour (discretes may cycle off).

6.3.5 PGNCS Power Supply Tests

6.3.5.1 From the CRT, confirm power supply voltages (or temperatures) are as specified and record values observed.

6.3.5.2 The PIPA Calibration Module Temperature (GG6020) shall be between +45 and +90 DEG F.

6.3.5.3 The PSA Temperature (GG6021) shall be between +60 and +110 DEG F.

6.3.5.4 The LGC Temperature (GG4300) shall be between +45 and +130 DEG. F.

6.3.5.5 The +28 VDC IMU OPERATE BUS (GG1500) shall be between 24.5 and 33.5 VDC.

6.3.5.6 The +28 VDC IMU STANDBY BUS (GG1510) shall be between 24.5 and 33.5 VDC.

6.3.5.7 The +28 VDC LGC OPERATE BUS (GG1520) shall be between 23.5 and 32.5 VDC.

6.3.5.8 The +120 VDC PIPA Supply (GG1040) shall be between 114 and 126 VDC.

6.3.5.9 The -28 VDC Supply (GG1100) shall be between -21.5 and -33.5 VDC.

6.3.5.10 The +4 VDC CDU Supply (GG1070) shall be between 3.8 and 4.2 VDC.

6.3.5.11 The IMU 28V 800 CPS 1 pct Supply (GG1201) shall be between 27.44 and 28.56 VRMS.

6.3.5.12 The IMU 28V 800 CPS 5 pct 90 PH Supply (GG1202) shall be between 26.6 and 29.4 VRMS.

6.3.5.13 The IMU 28V 800 CPS 5 pct 0 PH Supply (GG1203) shall be between 25.9 and 30.1V RMS.

6.3.5.14 The 3.2 KC 28V Supply (GG1331) shall be between 28.04 and 29.16V RMS.

6.3.5.15 The 2.5 VDC T/M Bias (GG1110) shall be between 2.4 and 2.6 VDC.

6.3.5.16 The +14 VDC LGC Supply (GG1020) shall be between 13.6 and 14.4 VDC.

6.3.5.17 The +4 VDC LGC Supply (GG1030) shall be between 3.8 and 4.2 VDC.

6.3.5.18 The phase difference between the 3.2 KC supply and LGC sync shall be 0° ±10° (NG1336).

6.3.7 PGNCS Operational Test

6.3.7.1 On K-148, enter the following sequence:

VERB 21 NOUN 01	ENTR
1220	ENTR
43733	ENTR
NOUN 15	ENTR
00006	ENTR, ENTR
03012	ENTR, ENTR
00004	ENTR, ENTR
13243	ENTR, ENTR
25563	ENTR, ENTR
01220	ENTR

6.3.7.1.1 Start the PGNCS Operational test by inserting the following sequence into K-148:

VERB 57 ENTR
00010 ENTR
Program 07 shall be displayed
VERB 33 NOUN 01 is displayed flashing

6.3.7.2 Command Accuracy 0°

6.3.7.2.1 On K-148, press ENTR

VERB 33 NOUN 02 is displayed flashing
On Event Module ISS WARNING Lamp may light
Press ENTR
VERB 33 NOUN 03 is displayed flashing

6.3.7.2.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 000±001 degrees.

6.3.7.2.3 Read and record CRT the DSKY Row 1, 2, and 3 indications. The indications shall be +00000±00007.

6.3.7.3 Command Accuracy 45°

6.3.7.3.1 On K-148, press ENTR, VERB 33 NOUN 04 is displayed flashing after approximately 20 seconds.

6.3.7.3.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 045±001 degrees.

6.3.7.3.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +04500±00007.

6.3.7.4 CDU Repeating Accuracy 45°

6.3.7.4.1 On K-148 press ENTR. In about 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.4.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.5 Command Accuracy 90°

6.3.7.5.1 On K-148 Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 06 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.5.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 090±001 degrees.

6.3.7.5.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be +09000±00007.

6.3.7.6 Command Accuracy 135°

6.3.7.6.1 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 07 is displayed flashing.

6.3.7.6.2 Read and record the CRT indication of IMU gimbal angles. The indications shall be 135±001 degrees.

6.3.7.6.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +13500±00007.

6.3.7.7 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 10 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.8 CDU Repeating Accuracy 135°

6.3.7.8.1 On K-148 press ENTR pushbutton. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.8.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.9 + Gimbal Lock Test

6.3.7.9.1 On K-148, Press VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 12 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.10 Command Accuracy 225°

6.3.7.10.1 On K-148 press ENTR. In approximately 20 seconds, VERB 33, NOUN 13 is displayed flashing.

6.3.7.10.2 Read and record the CRT indication of IMU gimbal angles. The indication shall be 225±001 degrees.

6.3.7.10.3 Read and record CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +225±00007.

6.3.7.11 On K-148 press ENTR. In approximately 20 seconds VERB 33 NOUN 14 is displayed.flashing. The GIMBAL LOCK lamp shall not be lighted.

6.3.7.12 CDU Command Rate Test

6.3.7.12.1 On K-148 press ENTR. In approximately 30 seconds VERB 06 NOUN 66 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.12.2 Read and record the CRT DSKY Row 1, 2, and 3 indications. The indication shall be between 00012 and 00016.

6.3.7.12.3 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.12.4 On K-148 insert VERB 33 ENTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on the DSKY shall not be lighted.

6.3.7.13 Command Accuracy 315°.

6.3.7.13.1 On K-148 insert VERB 33 ENTR. In approximately 20 seconds VERB 33 NOUN 20 will be displayed flashing.

6.3.7.13.2 Read and record CRT indication of IMU gimbal angles. The indications shall be 315±001 degrees.

6.3.7.13.3 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indications shall be +315±00007.

6.3.6.14 CDU Repeating Accuracy 315°

6.3.7.14.1 On K-148 press ENTR. In approximately 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.14.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.

6.3.7.15 -Gimbal Lock Test

6.3.7.15.1 On K-148 Press VERB 33 ENTR. In approximately 20 seconds VERB 33, NOUN 22 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.15.2 On K-148 Press ENTR. In approximately 20 seconds VERB 33 NOUN 23 will be displayed flashing.

6.3.7.15.3 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indications shall be

Row 1 22500±00007
Row 2 22500±00007
Row 3 00000±00007

6.3.7.16 CDU Repeating Accuracy 225°

6.3.7.16.1 On K-148, press ENTR. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.16.2 Read and record the CRT DSKY rows 1, 2, and 3 indications. The indication shall be between 77774 and 00003.

6.3.7.17 On K-148 Press VERB 33 ENTR. The GIMBAL LOCK lamp shall not be lighted. VERB 21, NOUN 22 is displayed flashing.

6.3.7.18 IMU CDU Fine Fail Test

6.3.7.18.1 On K-148 insert the following sequence

+00100 ENTR
+00100 ENTR
+00100 ENTR
On Event Module verify that ISS WARNING lamp lights in approximately 90 seconds.

6.3.7.18.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display Row 1 indicates 33XXX or 32XXX.

6.3.7.19 IMU CDU Coarse Fail Test

6.3.7.19.1 On K-148 insert the following sequence

VERB 33 ENTR
+03375 ENTR
+03375 ENTR
+03375 ENTR
On Event Module verify that ISS WARNING lamp lights in approximately 90 seconds.

6.3.7.19.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display of Row 1 indicates 33XXX or 32XXX.

6.3.7.20 FDAI Linearity Test

6.3.7.20.1 On K-148, enter the following:

VERB 21 NOUN 01 ENTR
2545 ENTR
1220 ENTR
VERB 33 ENTR
VERB 33 NOUN 27 shall be displayed

6.3.7.20.2 On CRT verify the following:

PITCH ATT ERROR is between +15.3 and +18.7 DEG (GG2219)
YAW ATT ERROR is between +15.3 and +18.7 DEG (GG2249)
ROLL ATT ERROR is between +15.3 and +18.7 DEG (GG2279)

6.3.7.20.3 On K-148, enter the following:

VERB 21 NOUN 01 ENTR
2545 ENTR
1220 ENTR
VERB 33 ENTR
VERB 33 NOUN 30 shall be displayed

6.3.7.20.4 On CRT verify the following:

PITCH ATT ERROR is between +14.4 and +17.6 DEG (GG2219)
YAW ATT ERROR is between +14.4 and +17.6 DEG (GG2249)
ROLL ATT ERROR is between +14.4 and +17.6 DEG (GG2279)

6.3.7.20.5 On K-148, enter the following:

VERB 21 NOUN 01 ENTR
2545 ENTR
1220 ENTR
VERB 33 ENTR
VERB 33 NOUN 31 shall be displayed.

6.3.7.20.6 On CRT verify the following:

PITCH ATT ERROR is between +05.4 and +06.6 DEG (GG2219)
YAW ATT ERROR is between +05.4 and +06.6 DEG (GG2249)
ROLL ATT ERROR is between +05.4 and +06.6 DEG (GG2279)

6.3.7.20.7 On K-148, enter the following:

VERB 21 NOUN 01 ENTR
2545 ENTR
1220 ENTR
VERB 33 ENTR
VERB 33 NOUN 32 shall be displayed.

6.3.7.20.8 On CRT verify the following:

PITCH ATT ERROR is between +00.2 and -00.2 DEG (GG2219)
YAW ATT ERROR is between +00.2 and -00.2 DEG (GG2249)
ROLL ATT ERROR is between +00.2 and -00.2 DEG (GG2279)

6.3.7.20.9 On K-148, enter the following:

VERB 21 NOUN 01 ENTR
2545 ENTR
1220 ENTR
VERB 33 ENTR
VERB 33 NOUN 33 shall be displayed

6.3.7.20.10 On CRT verify the following:

PITCH ATT ERROR is between -05.4 and -06.6 DEG (GG2219)
YAW ATT ERROR is between -05.4 and -06.6 DEG (GG2249)
ROLL ATT ERROR is between -05.4 and -06.6 DEG (GG2279)

6.3.7.20.11 On K-148 enter the following:

VERB 21 NOUN 01 ENTR
2545 ENTR
1220 ENTR
VERB 33 ENTR
VERB 33 NOUN 34 shall be displayed.

6.3.7.20.12 On CRT verify the following:

PITCH ATT ERROR is between -14.4 and -17.6 DEG (GG2219)
YAW ATT ERROR is between -14.4 and -17.6 DEG (GG2249)
ROLL ATT ERROR is between -14.4 and -17.6 DEG (GG2279)

6.3.7.20.13 On K-148, enter the following:

VERB 21 NOUN 01 ENTR
2545 ENTR
1220 ENTR
VERB 33 ENTR
VERB 33 NOUN 35 shall be displayed.

6.3.7.20.14 On CRT verify the following:

PITCH ATT ERROR is between -15.3 and -18.7 DEG (GG2219)
YAW ATT ERROR is between -15.3 and -18.7 DEG (GG2249)
ROLL ATT ERROR is between -15.3 and -18.7 DEG (GG2279)

6.3.7.21 On K-148 enter VERB 36 ENTR. The proper operation of the IMU CAGE function (consisting of steps 6.3.7.21 thru 6.3.7.23) need be performed only once during the initial PGNCS Operational Test and omitted from subsequent testing of test 6.3.7.

6.3.7.21.1 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00500 ENTR
+00500 ENTR
+00500 ENTR

6.3.7.21.2 On the CRT, verify all IMU gimbal angles indicate between 003 and 007 DEG.

6.3.7.21.3 On analog recorder, monitor the following signals:

	SIGNAL NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2106	IG Servo Error Total
c.	GG2166	OG Servo Error Total
d.	GG2112	IG 1X Resolver Sine
e.	GG2172	OG 1X Resolver Sine
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps

6.3.7.21.4 Start analog recorder to a chart speed of 5 mm/sec.

6.3.7.21.5 On LEM Cabin Panel 4, hold IMU CAGE momentary toggle switch in the ON position. (Do not release).

6.3.7.21.6 On analog recorder, verify the 1X Resolver Sine signals (GG2112, GG2172, GG2142) null out to less than 0.5V rms. Release IMU CAGE switch to the OFF position. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Any sustained oscillations shall be cause for immediate removal of IMU Operate power.

6.3.7.21.7 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.7.22 Stop analog recorder.

6.3.7.22.1 On K-148 insert the following:

VERB 43 ENTR
+01700 ENTR
+00600 ENTR
-01700 ENTR

On CRT verify the following:

YAW ATT ERROR is between +15.3 and +18.7 Deg. (GG2249).
PITCH ATT ERROR is between +05.4 and +06.6 Deg (GG2219).
ROTT ATT ERROR is between -15.3 and -18.7 Deg (GG2279).

6.3.8 IRIG Scale Factor Determination

6.3.8.1 Insure that the IMU Operate power and LGC Operate power have been applied for a minimum of one hour and that the IMU is not in a gimbal lock condition.

6.3.8.2 On meter module monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.8.3 On K-148 enter the following sequence:

VERB 57 ENTR
00005 ENTR

6.3.8.4 PROG 07 shall be displayed.

6.3.8.5 VERB 06 NOUN 61 shall flash.

6.3.8.6 On the CRT DSKY, Verify contents of Row 1 (Navigation Base azimuth) and Row 2 (Site latitude shall be displayed).

6.3.8.7 If values for Row 1 and Row 2 are correct, proceed to the next step.
If values for Row 1 and Row 2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR
±xxxxx ENTR (Correct navigation base azimuth)
+40748 ENTR (Correct site latitude)
Verify values in Row 1 and Row 2 are correct.

6.3.8.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.8.

6.3.8.9 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from CRT DSKY Row 1 (+X IRIG Scale Factor error in part per million, Position +00001)

6.3.8.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.10.

6.3.8.11 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor error in parts per million, Position +00002).

6.3.8.12 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.12.

6.3.8.13 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position +00003).

6.3.8.14 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.14.

6.3.8.15 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row (-X IRIG Scale Factor error in parts per million, Position -00001).

6.3.8.16 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.16.

6.3.8.17 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor error in parts per million, Position -00002).

6.3.8.18 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM is ON, enter VERB 36 ENTR and repeat steps, 6.3.8.3 through 6.3.8.7 and 6.3.8.18.

6.3.8.19 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position -00003).

6.3.8.20 Repeat steps 6.3.8.8 through 6.3.8.19 twice to obtain second and third set of data.

6.3.8.21 Terminate this test by entering in K-148 the following:

VERB 34 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.8.22 The average of the three readings of Scale Factor Error for each of the 6 positions shall be 0 ± 1750 PPM.

6.3.9 IMU Performance Test. A reference data sheet is provided at the end of this section to aid in data reduction. [illegible]

6.3.9.1 Insure that IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.9.2 On CRT display, monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.9.3 Adjust oscilloscope to display butterfly of X PIPA.

6.3.9.4 On K-148 enter the following:

VERB 01 NOUN 10 ENTR
00003 ENTR
Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.9.5 On K-148 enter the following:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 02 ENTR
01300 ENTR
Record CRT DSKY Row 1 indications as ±BBBBB.

6.3.9.6 Perform the following calculations:

a. $\frac{\text{BBBBB} \times 5.12}{3600}$ = CCCC.C (Contents (hrs) of high order scalar register)

b. 23.3 - CCCC.C = DDDD.D hours.

c. DDDD.D + present time of day = time of day at which high order scalar register will overflow.

6.3.9.7 If the time of day is within 12 minutes of that calculated in 6.3.9.6.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.9.6.c has passed and proceed.

Paragraph

6.3.9.15
6.3.9.22
6.3.9.30
6.3.9.36
6.3.9.43
6.3.9.48

6.3.9.8 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTR
00370 ENTR
Record contents of CRT DSKY Row 1 XXXXY
VERB 21 NOUN 01 ENTR
00370 ENTR
XXXXY' ENTR
Where Y' is obtained from Table 1a.
VERB 57 ENTR
00001 ENTR
VERB 06 NOUN 61 shall flash

6.3.9.9 On the CRT, DSKY display verify R1 (Navigation Base Azimuth) and R2 (Site Latitude) are correct.

6.3.9.10 If values for R1 and R2 are correct, proceed to next step.
If values for R1 and R2 are incorrect, enter the following sequence into K-148.

VERB 24 ENTR
±xxx.xx ENTR (Correct navigation base azimuth ±0.50 deg)
+40.748 ENTR (Correct site latitude)
Verify values in R1 and R2 are correct.

6.3.9.11 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.12 On CRT, DSKY display, verify R1 = +00600 (Time), R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position). If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00600 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00001 ENTR (Test Position Entry)

6.3.9.13 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.14 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 (+NBDY Position +00001).

6.3.9.15 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.16 Deleted. ~~[illegible]~~

6.3.9.17 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (+X PIPA Position +00001). Row 1 is whole part, Row 2 is fractional part. Units are cm/sec^2.

6.3.9.18 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.19 On CRT, DSKY display - verify R1 = +00600, R2 = +00000, and R3 = +00002.

6.3.9.20 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.21 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDZ Position +00002).

6.3.9.22 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.23 Approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (-X PIPA Position +00002).

6.3.9.24 On K-148 enter the following sequence:

VERB 33 ENTR
Record CRT CDU gimbal angle indications and time.

6.3.9.25 In approximately 67 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX + ADIAX Pos +00002). Record CRT CDU gimbal angle indications and time.

6.3.9.26 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.27 On CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00003.

6.3.9.28 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.29 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX Position +00003).

6.3.9.30 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.31 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Z PIPA Position +00003).

6.3.9.32 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.33 On the CRT, DSKY display verify R1 = +00600, R2 = 00000, and R3 = +00004.

6.3.9.34 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.35 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDY + ADSRAY Position +00004).

6.3.9.36 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.37 Deleted.

6.3.9.38 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (-Z PIPA Position +00004).

6.3.9.39 On K-148 enter the following sequence:

VERB 33 ENTR

Restore [illegible].

6.3.9.40 In approximately 67 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display record R2 (+NBDZ + ADIAZ Position +00004). Record [illegible] CDU gimbal angle indications [illegible].

6.3.9.41 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.42 From the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00005.

6.3.9.43 Record time; On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.44 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.45 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Y PIPA Position +00005). Correct measured g term per Para 6.3.9.70.1 and transfer results to line k.

6.3.9.46 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.47 On the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00006.

6.3.9.48 Record time; On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.49 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.3.9.50 In approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2. (-Y PIPA Position +00006). Correct measured g term per Para 6.3.9.70.1 and transfer results to line l.

6.3.9.51 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.52 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000 and R3 = +00007.

6.3.9.53 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.54 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+.707 ADSRAX-NBDX Position +00007).

6.3.9.55 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.56 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00008.

6.3.9.57 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.58 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 [-.707 (NBDZ+NBDY) +0.5 (ADIAZ - ADIAY) +0.5 (ADSRAY + ADSRAZ)] (Position + 00008).

6.3.9.59 On K-148 enter the following:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.60 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00009.

6.3.9.61 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.62 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display, record R2 (-NBDZ + .707 ADSRAZ Position +00009).

6.3.9.63 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.64 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00010.

6.3.9.65 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.66 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 [.707 (NBDY-NBDX) +.5 (ADIAY - ADIAX) +.5 ADSRAX] (Position +00010).

6.3.9.67 Terminate this test by entering in K-148 the following:

VERB 36 ENTR

6.3.9.68 On CRT, record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).

6.3.9.69 On K-148 enter the following sequence:
VERB 41 NOUN 20 ENTER
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.9.70 Calculations

NOTE: Use Post Vibration or System Test data points only.

6.3.9.70.1 Y PIPA Data Correction Calculation

6.3.9.70.1.1 From the uplink file tape, the compressed data tape or the PCM tape, request a data reduction of the X and Z accelerometer ΔV counts (addresses 37 and 41, respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) for the period during which the Y PIPA test was being performed in positions 5 and 6 of the IMU Performance test.

6.3.9.70.1.2 Perform the following calculations for position 5.

$$G_5' = \frac{G_5}{\text{Cos } \theta y_5}$$

where:

G_5' = Measured acceleration term (line k)

G_5' = Corrected acceleration term

$\text{Cos } \theta y_5 = 1 - \frac{1}{\theta^2 y_5}$ for small angles

where:

$$\theta y_5 = \sqrt{\theta^2 x_5 + \theta^2 z_5}$$

and:

$$\theta z_5 = \frac{(\Delta Vx5 - \Delta Vx \text{ Bias})\ (\text{S.F.}_x)}{(\Delta T)\ (\text{local g})}$$

$$\theta x_5 = \frac{(\Delta Vz5 - \Delta Vz \text{ Bias})\ (\text{S.F.}_z)}{(\Delta T)\ (\text{local g})}$$

and:

$$V_x \text{ Bias} = \frac{(\text{X PIPA Bias})\ (\Delta T)}{\text{S.F.}_x}$$

$$V_z \text{ Bias} = \frac{(\text{Z PIPA Bias})\ (\Delta T)}{\text{S.F.}_z}$$

S.F. and Bias terms are obtained from positions 1 through 4 of the IMU Performance Test.

6.3.9.70.1.3 Perform the following calculations for position 6.

$$G_6' = \frac{G_6}{\cos \theta y_6}$$

where:

G_6 = Measured acceleration term (line e)

G_6' = Corrected acceleration term

$\cos \theta y_6 = 1 - \frac{1}{\theta^2 y_6}$ for small angles

$$\theta y_6 = \sqrt{\theta^2 x_6 + \theta^2 z_6}$$

and:

$$\theta z_6 = \frac{(\Delta Vx6 - \Delta Vx \text{ Bias})\ (S.F._x)}{(\Delta T)\ (\text{local } g)}$$

$$\theta x_6 = \frac{(\Delta Vz6 - \Delta Vz \text{ Bias})\ (S.F._z)}{(\Delta T)\ (\text{local } g)}$$

and:

$$V_x \text{ Bias} = \frac{(\text{X PIPA Bias})\ (\Delta T)}{S.F._x}$$

$$V_z \text{ Bias} = \frac{(\text{Z PIPA Bias})\ (\Delta T)}{S.F._z}$$

S.F. and Bias terms are obtained from positions 1 through 4 of the IMU Performance Test.

6.3.9.70 Calculations

NOTE: Use Post Vibration or System Test data points only.

6.3.9.70.2 Obtain data from last IRIG and/or PIPA test and fill in Data Sheet x_{i-1}.

6.3.9.70.3 Obtain data from second last IRIG and/or PIPA test and fill in Data Sheet x_{i-2}.

6.3.9.70.4 Obtain data from third last IRIG and/or PIPA test and fill in Data Sheet x_{i-3}.

6.3.9.70.5 Perform the following calculations for each item appearing on Data Sheet x_i and transfer all results to lines au through bi.

NOTE:

See paragraph 5.6 before continuing

$$D_1 = \left| x_{i-1} - x_i \right|$$

$$D_2 = \left| x_{i-1} - x_i \right| + \left| x_{i-2} - x_{i-1} \right|$$

$$D_3 = \left| x_{i-3} - x_{i-2} \right| + \left| x_{i-2} - x_{i-1} \right| + \left| x_{i-1} - x_i \right|$$

6.3.10 LGC Voltage Margin Test

6.3.10.1 Initial Conditions

6.3.10.1.1 Insure that the G&N System is in the Standby Mode.

6.3.10.1.2 On the CRT, verify the +28 VDC LGC OPERATE bus is between 24.5 and 33.5 vdc (GG 1520).

6.3.10.1.3 On Panel 5 set lighting override ANUN SW to ON. Rotate the ANUN/NUM dimmer fully CCW.

6.3.10.2 Voltage Margin Determination

6.3.10.2.1 On the PSA Adapter Module (PSAAM) (410-31080), place INHIBIT VOLTAGE FAIL switch to ON.

CAUTION: The +4 vdc LGC Supply voltage shall never be operated lower than +2.5 vdc or higher than +5.2 vdc (GG1030).

The +14 vdc LGC Supply shall never be operated less than +8.5 vdc or higher than +17.0 vdc (GG 1020). LTG-ANUN/NUM Control on panel 5 shall be set to DIM during the performance of the Voltage Margin Test in order to avoid decreasing the operating life of the DSKY EL lamps. indication of the LGC supplies may be disregarded for this test.
The charts in Table II may be used to determine approximate values for "XX.X" values
NOTE: The flashing indication of the LGC supplies may be disregarded for this test. The charts in Table II may be used to determine approximate values for "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9. 14	+N BDY Position +00001 Transfer result to line af	meru	( ) ---.--	a.
6.3.9. 17	+X PIPA Test Position +00001	cm/sec^2	( ) 00---. ( )-----	b.
6.3.9. 21	+N BDZ Position +00002 Transfer result to line ag	meru	( ) ---.--	c.
6.3.9. 23	-X PIPA Test Position +00002	cm/sec^2	( ) 00---. ( )-----	d.
6.3.9. 25	-N BDX + ADIAX Position +00002	meru	( ) ---, --	e.
6.3.9. 29	-N BDX Position +00003 Multiply by -1 and transfer result to line ah	meru	( ) ---.--	f.
6.3.9. 31	+Z PIPA Test Position +00003	cm/sec^2	( ) 00---. ( ) -----	g.
6.3.9. 35	+N BDY + ADSRAY Position +00004	meru	( ) ---.--	h.
6.3.9. 38	-Z PIPA Test Position +00004	cm/sec^2	( ) 00---. ( ) -----	i.
6.3.9. 40	+N BDZ + ADIAZ Position +00004	meru	( ) ---.--	j.
6.3.9. 45	+Y PIPA Test Position +00005	cm/sec^2	( ) 00---. ( ) -----	k.
6.3.9. 50	-Y PIPA Test Position +00006	cm/sec^2	( ) 00---. ( ) -----	l.

DATA SHEET

ITEM NO.	PARAMETER	UNITS	RECORDED VALUE	
6.3.9.54	-NBDX+ .707 ADSRAX Position +00007	meru		m.
6.3.9.58	-.707 (NBDZ+NBDY) +0.5 (ADIAZ-ADIAY) +0.5 (ADSRAY+ADSRAZ) Position +00008	meru		n.
6.3.9.62	-NBDZ+.707ADSRAZ Position +00009	meru		o.
6.3.9.66	.707(NBDY-NBDX) +.5 (ADIAY-ADIAX) +.5 ADSRAX Position +00010	meru		p.

DATA SHEET

CALCULATION	PARAMETER	UNITS	
line c - line f = ( ) ---.-- (-NBDX+ADIAX) - (-NBDX) Transfer result to line al.	ADIAX	meru/g	q
line h - line a = ( ) ---.-- (+NBDY+ADSRAY) - (+NBDY) Transfer result to ai.	ADSRAY	meru/g	r
line j - line c = ( )---.--- (+NBDZ+ADIAZ) - (NBDZ) Transfer result to line am.	ADIAZ	meru/g	s
(line m - line f)X1.414 = ( ) ---.-- [(-NBDX + .707 ADSRAX) - (-NBDX)] X 1.414 Transfer result to line ak.	ADSRAX	meru/g	t
(line e + line c) X1.414 = ( ) ---.-- (-NBDZ + .707 ADSRAZ + NBDZ) X1.414 Transfer result to line ai.	ADSRAZ	meru/g	u
(line p - .707 line a - .707 line f +.5 line q -.5 line t) X2 = ---.-- [.707 (NBDY-NBDX) +.5 (ADIAY-ADIAX) +.5 ADSRAX -.707 (-NBDX) -.707 NBDY +.5 ADIAX-.5 ADSRAX] X2 Transfer result to line an.	ADIAY	meru/g	v
line b - line d = ( )	PIPA X2G	cm/sec^2	w
line k - line l = ( )	PIPA Y2G	cm/sec^2	x
line g - line i = ( )	PIPA Z2G	cm/sec^2	y
1960.52 ÷ line w x 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line ao.	X PIPA S. F.	cm/sec/ pulse	z
1960.52 ÷ line x X 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line ap.	Y PIPA S. F.	cm/sec/ pulse	aa
1960.52 ÷ line y X 1 cm/sec/pulse = Subtract 1.000000 from this value, multiply x 10^6 and transfer results to line aq.	Z PIPA S. F.	cm/sec/ pulse	ab
1/2 (line b + line d) = ( ) --.-- Transfer results to line ar	X PIPA Bias	cm/sec^2	ac
1/2 (line k + line l) = ( ) --.--- Transfer results to line as	Y PIPA Bias	cm/sec^2	ad
1/2 (line g + line i) = ( ) --.--- Transfer results to line at	Z PIPA Bias	cm/sec^2	ae

TABLE I

Y	Y'
0	2
1	3
2	2
3	3
4	6
5	7
6	6
7	7

DATA SHEET
(x_1)

PARAMETER	UNITS	MIN VALUE	RECORDED VALUE	MAX VALUE	REJ	ACC	
NBDY	meru	-15		+15			af
NBDZ	meru	-15		+15			ag
NBDX	meru	-15		+15			ah
ADSRAY	meru/g	-40		+40			ai
ADSRAZ	meru/g	-40		+40			aj
ADSRAX	meru/g	-40		+40			ah
ADIAX	meru/g	-100		+100			al
ADIAZ	meru/g	-100		+100			am
ADIAY	meru/g	-100		+100			an
X PIPA S. F. error from line z	PPM	-1900		+1900			ao
Y PIPA S. F. error from line aa	PPM	-1900		+1900			ap
Z PIPA S. F. error from line ab	PPM	-1900		+1900			aq
X PIPA Bias from line ac	cm/sec^2	-3.1		+3.1			ar
Y PIPA Bias from line ad	cm/sec^2	-3.1		+3.1			as
Z PIPA Bias from line ae	cm/sec^2	-3.1		+3.1			at

DATA SHEET
(x_{i-1})

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru/g	
ADSRAZ	meru/g	
ADSRAX	meru/g	
ADIAX	meru/g	
ADIAZ	meru/g	
ADIAY	meru/g	
X PIPA S.F. error	PPM	
Y PIPA S.F. error	PPM	
Z PIPA S.F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET
(x_1-2)

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru/g	
ADSRAZ	meru/g	
ADSRAX	meru/g	
ADIAX	meru/g	
ADIAZ	meru/g	
ADIAY	meru/g	
X PIPA S. F. error	PPM	
Y PIPA S. F. error	PPM	
Z PIPA S. F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET
(x_{1-3})

PARAMETER	UNITS	RECORDED VALUE
NBDY	meru	
NBDZ	meru	
NBDX	meru	
ADSRAY	meru/g	
ADSRAZ	meru/g	
ADSRAX	meru/g	
ADIAX	meru/g	
ADIAZ	meru/g	
ADIAY	meru/g	
X PIPA S. F. error	PPM	
Y PIPA S. F. error	PPM	
Z PIPA S. F. error	PPM	
X PIPA Bias	cm/sec^2	
Y PIPA Bias	cm/sec^2	
Z PIPA Bias	cm/sec^2	

DATA SHEET

PARAMETER	UNITS	D_1	MAX	D_2	MAX	D_3	MAX	
NBDY	meru		6		9		11	au
NBDZ	meru		6		9		11	av
NBDX	meru		6		9		11	aw
ADSRAY	meru/g		14		21		25	ax
ADSRAZ	meru/g		14		21		25	ay
ADSRAX	meru/g		14		21		25	az
ADIAX	meru/g		17		33		40	ba
ADIAZ	meru/g		17		33		40	bb
ADIAY	meru/g		17		33		40	bc
X PIPA S. F.	Error PPM		400		500		600	bd
Y PIPA S. F.	Error PPM		400		500		600	be
Z PIPA S. F.	Error PPM		400		500		600	bf
X PIPA Bias	cm/sec^2		0.5		0.7		0.9	bg
Y PIPA Bias	cm/sec^2		0.5		0.7		0.9	bh
Z PIPA Bias	cm/sec^2		0.5		0.7		0.9	bi

6.3.10.2.2 Enter 0001 into R155. Verify and execute.

6.3.10.2.3 Enter 1111 into R154. Verify and execute.

6.3.10.2.4 Enter in C-156 ±XX.X001114. (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 12.2 (+0.3, -0) vdc. See Table II). Execute.

6.3.10.2.5 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the +4V power supply (GG 1030) as monitored on the CRT, to 3.5 (+0.15, -0) vdc. See Table II). Execute.

6.3.10.2.6 On K-148 press ERROR RESET.

6.3.10.2.7 On K-148 initiate LGC Self-Check by entering the following:

VERB 21 NOUN 27 ENTR
77767 ENTR

Wait 200 seconds. Verify RESTART lamp on the DSKY is not lit.

6.3.10.2.7.1 Into R154 insert 0011. Verify and execute.

6.3.10.2.8 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.9 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to ON. Into R-154 insert 1111. Verify and execute. Press ERROR RESET. Perform the following DSKY operations.

VERB 21 NOUN 27 ENTR
77767 ENTR

6.3.10.2.10 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 16.4 (+0, -0.4) vdc. See Table II. Execute.

6.3.10.2.11 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.11.1 Into R154 insert 1100. Verify and execute.

6.3.10.2.12 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted. Set the INHIBIT VOLTAGE FAIL switch to ON. Into R-154 insert 1111. Verify and execute. Press ERROR RESET. Perform the following DSKY operations.

VERB 21 NOUN 27 ENTR
77767 ENTR

6.3.10.2.13 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the 4V power supply (GG 1030) as monitored on the CRT, to 4.6 (+0, -0.2) vdc. See Table II). Execute.

6.3.10.2.14 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.

6.3.10.2.14.1 Into R154 insert 0011. Verify and execute.

6.3.10.2.15 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lit. Set the INHIBIT VOLTAGE FAIL switch to ON. Into R-154, insert 1111. Verify and execute. Press ERROR RESET. Perform the following DSKY operations:

```
VERB 21 NOUN 27 ENTR
77767           ENTR
```

6.3.10.2.16 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the 14V power supply (GG 1020) as monitored on the CRT, to 12.2 (+0.3, -0) vdc. See Table II). Execute.

6.3.10.2.17 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.

6.3.10.2.17.1 Into R154 insert 1100. Verify and execute.

6.3.10.2.18 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.19 On R-154 enter 0000. Execute.

6.3.10.2.20 On R-155 enter 0000. Execute.

6.3.10.2.21 On K-148 terminate the LGC Self-Check by entering the following:

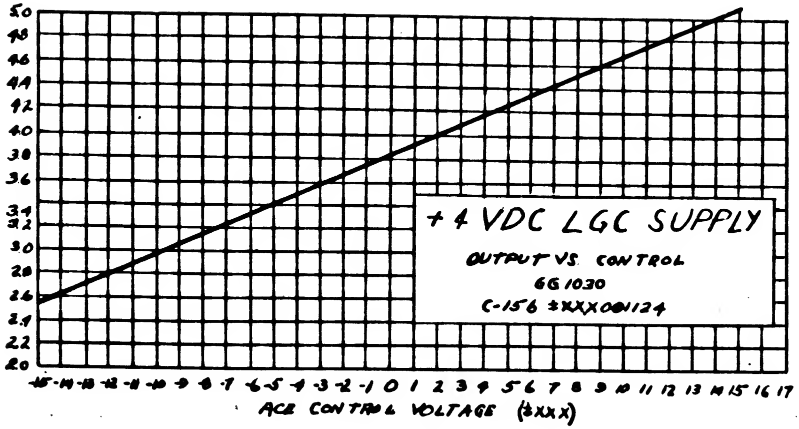
```
VERB 21  NOUN 27  ENTR
00000             ENTR
```

6.3.10.2.22 On K-148 press ERROR RESET.

6.3.11 LGC Clock Frequency Test

6.3.11.1 Insure that LGC Operate power has been applied for a minimum of 10 minutes before performing this test.

6.3.11.2 Verify that the counter is connected to the 3.2kc signal on the hardline.


5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
ACE CONTROL VOLTAGE (±X.X X)
+4 VDC LGC SUPPLY
OUTPUT VS. CONTROL
6G 1030
C-156 ±XXX00124

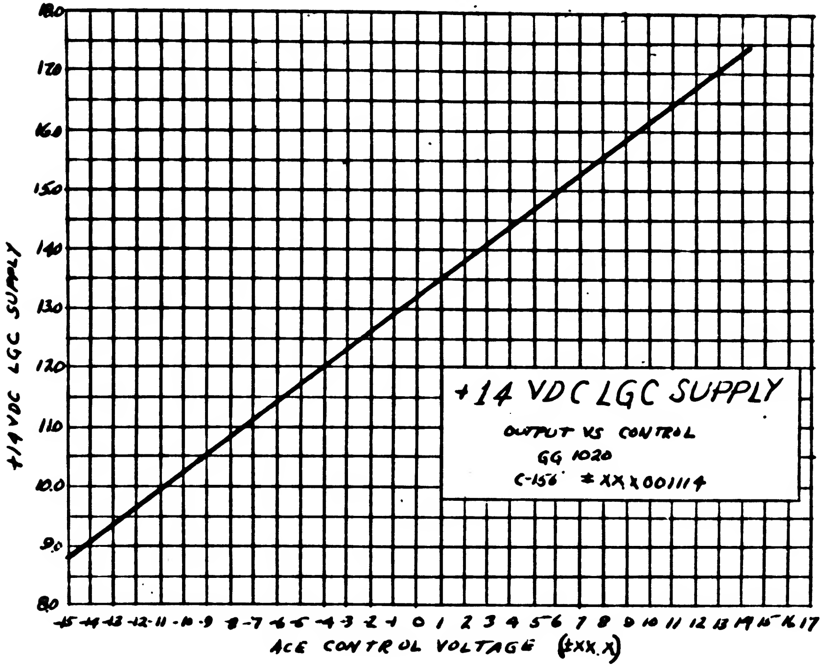

18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
+14 VDC LGC SUPPLY
-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
ACE CONTROL VOLTAGE (±XX.X)
+14 VDC LGC SUPPLY
OUTPUT VS CONTROL
GG 1020
C-156 ±XXX00114

TABLE II

6.3.11.3 Insure that the counter has been warming up for a minimum of 30 minutes.

6.3.11.4 On the counter,

Set the FUNCTION switch to: MAN START
Set the TIME BASE switch to: 1 μs TIME UNIT/COUNT
Set the SENSITIVITY control to: CHECK

6.3.11.5 Verify proper counter operation.

6.3.11.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.

6.3.11.7 Plug in the Preset unit and set:

MODE switch to PRESET
N switches to 96000

6.3.11.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.

6.3.11.9 Start counting by depressing RESET switch on counter.

6.3.11.10 After approximately 30 seconds, read and record counter display.

6.3.11.11 Repeat steps 6.3.11.9 and 6.3.11.10 9 times.

6.3.11.12 The average of the 10 previous readings shall be 30.000000±0.000060 seconds.

6.3.11.13 Insure that the System is not in IMU Operate.

6.3.11.14 Enter the following on K-146 operations.

VERB 2 VERB 60 ENTR
00013 Press and hold the STBY pushbutton on the DSKY for 3
02000 seconds. Verify the STANDBY lamp is lighted.
ENTR

6.3.11.15 Repeat steps 6.3.11.9 through 6.3.11.12.
Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is lighted.

6.3.11.15 Repeat steps 6.3.11.9 through 6.3.11.[illegible].

6.3.11.16 Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is not lighted. Restart light may be on. Enter VERB 61 ENTR into K-148.

6.3.11.17 On the Computer Control and Reticle dimmer assembly, press and hold MARK X pushbutton.

6.3.11.18 On the DSKY observe

VERB 05 NOUN 31
Row 1 = 00112
Prog Alarm lamp is lighted
Press Error Reset

6.3.11.19 Enter the following on K-148

VERB 11 NOUN 10 ENTR
00016 ENTR

6.3.11.20 Observe that DSKY Row 1 displays 00004.

6.3.11.21 Release MARK X pushbutton

6.3.11.22 Observe that DSKY Row 1 displays 00000.

6.3.11.23 Press and hold the MARK Y pushbutton on the Computer Control and Reticle Dimmer Assembly.

6.3.11.23.1 On the DSKY Observe

VERB 05 NOUN 31
Row 1 = 00112
Program Alarm lamp is lighted
Press ERR Reset

6.3.11.23.2 Enter the following on K-148:

VERB 11 NOUN 10 ENTR
00016 ENTR

6.3.11.24 Observe that DSKY Row 1 displays 00010.

6.3.11.25 Release MARK Y pushbutton

6.3.11.26 Observe that DSKY Row 1 displays 00000.

6.3.11.27 Press and hold the REJECT pushbutton on the Computer Control and Reticle Dimmer Assembly.

6.3.11.27.1 On the DSKY observe

VERB 05 NOUN 31
Row 1 = 00112
Prog alarm lamp is lighted
Press ERR Reset

6.3.11.27.2 Enter the following on K-148:

VERB 11	NOUN 10	ENTR
00016		ENTR

6.3.11.28 Observe that DSKY Row 1 displays 00020.

6.3.11.29 Release the REJECT pushbutton.

6.3.11.30 Observe that DSKY Row 1 displays 00000.

6.3.11.31 On the DSKY perform the following operation

VERB 36 ENTR

6.3.11.32 On panel 11 close PGNS AOT lamp circuit breaker. On the Computer Control and Reticle dimmer assembly, rotate the RETICLE BRIGHTNESS control to its minimum light intensity position. View through the AOT and verify that the reticle lamp is off.

6.3.11.33 While viewing through the AOT, slowly rotate the RETICLE BRIGHTNESS control to increase the reticle brightness until a stop is reached. Observe that the reticle brightness has increased in intensity. Return RETICLE BRIGHTNESS control to off state. On panel 11 open PGNS AOT lamp circuit breaker.

6.3.11.34 AOT eyepiece Heater Test.

6.3.11.34.1 Secure milliameter HP 428B and current probe HP428A-21A.

6.3.11.34.2 Locate P1 at Computer Control and Reticle Dimmer assembly. Push lacing cord away from P1 back to fifth tie point.

6.3.11.34.3 Clip current probe HP428A-21A to blue wire in cable with red arrow pointing away from P1. Measure and record current indication. The current shall be between 139 and 244 ma.

6.3.11.34.4 Remove current probe, push lacing cord back to P1 and spot tie.

6.3.12 Gimbal Friction Test

6.3.12.1 Inner Gimbal Friction Test

6.3.12.1.1 On K-148 enter the following sequence:

VERB 41	NOUN 20	ENTR
+00000		ENTR
+00000		ENTR
+00000		ENTR
Wait 15 seconds		
VERB 41	NOUN 20	ENTR
+17000		ENTR
+17000		ENTR
+17000		ENTR
Wait 15 seconds		

VERB 41	NOUN 20	ENTR
+27000		ENTR
+27000		ENTR
+27000		ENTR
Wait 15 seconds		
VERB 41	NOUN 20	ENTR
+00000		ENTR
+00000		ENTR
+00000		ENTR

6.3.12.1.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.1.3 Set up Analog Recorder to monitor the following signals:

MEAS. NO.	SIGNAL NAME
a. GG2110	IG Torque Motor Current
b. GG2106	IG Servo Error Total
c. GG2107	IG Servo Error in Phase
d. GG2112	IG 1x Resolver Sine
e. GG2113	IG 1x Resolver Cosine
f. GG2220	IG CDU Fine Error
g. GG1201	IMU 28V 1% 800 CPS
h. GG2221	IG CDU Coarse Error

6.3.12.1.4 Set up Analog Recorder to monitor the following signals:

MEAS NO.	SIGNAL NAME
a. GG2300	PIPA TEMP
b. GG2301	IRIG TEMP
c. GG1520	+28 VDC LGC OPR BUS

6.3.12.1.5 After 10 seconds has elapsed since step 6.3.12.1.1, enter the following into K-148.

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.1.6 Verify on CRT, DSKY display

VERB 21	NOUN 01
R1 =	00000
R3 =	00403

6.3.12.1.7 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR
37777	ENTR	ENTR
37743	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	(once)

6.3.12.1.8 IG - 360° TORQUE ers using a chart speed of 10 mm/sec (IG - 360° TORQUE

6.3.12.1.9 On K-148 enter the following sequence:

```
VERB 01   NOUN 01   ENTR
00370               ENTR
Record contents of CRT DSKY Row 1 xxxxY
VERB 21   NOUN 01   ENTR
00370               ENTR
XXXXY'              ENTR
Where Y' is obtained from Table 1
VERB 42             ENTR
VERB 33             ENTR
```

6.3.12.1.10 Monitor analog recorder. When the IG Torque Motor Current signal (GG2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.1.11 On K-148 enter the following sequence:

```
VERB 40   NOUN 20   ENTR   Wait 3 seconds
VERB 41   NOUN 20   ENTR
+00000    ENTR
+00000    ENTR
+00000    ENTR
```

6.3.12.1.12 On the CRT, verify CDU X, CDU Y, CDU Z all indicate +00000 (±00200).

6.3.12.1.13 After 10 seconds has elapsed since step 6.3.12.1.11 enter the following sequence into K-148:

```
VERB 21   NOUN 01   ENTR
00403     ENTR
00000     ENTR
```

6.3.12.1.14 Verify on CRT, DSKY display

VERB 21	NOUN 01
R1	00000
R3	00403

6.3.12.1.15 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR
40000	ENTR	ENTR
40034	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	(once)

6.3.12.1.16 IG + 360° TORQUE

6.3.12.1.17 On K-148 enter the following sequence

VERB 42	ENTR
VERB 33	ENTR

6.3.12.1.18 Monitor analog recorder. When the IG Torque Motor Current signal (GG2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.2 Outer Gimbal Friction Test

6.3.12.2.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+00000	ENTR		

6.3.12.2.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.3 Set up analog recorder to monitor the following:

MEAS NO.		SIGNAL NAME
a.	GG2167	OG Servo Error In Phase
b.	GG2170	OG Torque Motor Current
c.	GG2166	OG Servo Error Total
d.	GG2280	OG CDU Fine Error
e.	GG2172	OG 1x Resolver Sine
f.	GG2173	OG 1x Resolver Cosine
g.	GG2281	OG CDU Coarse Error

6.3.12.2.4 After 10 seconds has elapsed since step 6.3.12.2.1 enter the following sequence into K-148:

VERB 21	NOUN 01	ENTR
00403	ENTR	
37777	ENTR	

6.3.12.2.5 Verify on CRT, DSKY display

VERB 21	NOUN 01
R1	37777
R3	00403

6.3.12.2.6 On K-148 enter the following sequence:

NOUN 15	ENTR	
37743	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	(once)

6.3.12.2.7 OG - 360° TORQUE [illegible]

6.3.12.2.8 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.2.9 Monitor analog recorder. When the OG Torque Motor Current signal (GG2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.2.10 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+00000	ENTR		

6.3.12.2.11 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.12 After 10 seconds has elapsed since step 6.3.12.2.10, enter the following sequence into K-148.

VERB 21	NOUN 01	ENTR
00403	ENTR	
40000	ENTR	

6.3.12.2.13 Verify on CRT, DSKY display.

VERB 21	NOUN 01
R1	40000
R3	00403

6.3.12.2.14 On K-148 enter the following sequence:

NOUN 15	ENTR	
40034	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR

6.3.12.2.15 OG +360° TORQUE ters using a chart speed of 10 mm/sec (OG +360° TORQUE)

6.3.12.2.16 On K-148 enter the following sequence

VERB 42	ENTR
VERB 33	ENTR

6.3.12.2.17 Monitor analog recorder. When the OG Torque Motor Current signal (GG2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.3 Middle Gimbal Friction Test

6.3.12.3.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+06750	ENTR		

6.3.12.3.2 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = +06750±00200.

6.3.12.3.3 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2136	MG Servo Error Total
b. GG2137	MG Servo Error In Phase
c. GG2140	MG Torque Motor Current
d. GG2143	MG 1x Resolver Cosine
e. GG2250	MG CDU Fine Error
f. GG2142	MG 1x Resolver Sine
g. GG2251	MG CDU Coarse Error

6.3.12.3.4 After 10 seconds have elapsed since step 6.3.12.3.1, enter the following sequence into K-148:

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.3.5 Verify on CRT, DSKY display

VERB 21	NOUN 01
R1 =	0000
R3 =	00403

6.3.12.3.6 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
14000	ENTR	ENTR
00000	ENTR	(once)

6.3.12.3.7 MG + 135° TORQUE

6.3.12.3.8 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.3.9 Monitor analog recorder. When MG Torque Motor Current (GG2140) drops to a quiescent level (approximately 6 minutes), stop the recorders.

6.3.12.3.10 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
-06750	ENTR		

6.3.12.3.11 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = -06750±00200.

6.3.12.3.12 After 10 seconds has elapsed since step 6.3.12.3.10, enter the following sequence into K-148.

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.3.13 On the CRT, DSKY display verify:

VERB 21	NOUN 01
R1 =	00000
R3 =	00403

6.3.12.3.14 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR
00000	ENTR	ENTR
00000	ENTR	ENTR
63777	ENTR	ENTR
77777	ENTR	(once)

6.3.12.3.15 MG +135° TORQUE was using a chart speed of 10 mm./sec. (MG + 135° TORQUE)

6.3.12.3.16 On K-148 enter the following sequence:

VERB 42	ENTR
VERB 33	ENTR

6.3.12.3.17 Monitor analog recorder. When the MG Torque Motor Current signal (GG2140) drops to a quiescent level (approximately 6 minutes) stop the recorders.

6.3.12.3.18 On K-148 enter the following sequence:

VERB 41	NOUN 20	ENTR
+00000	ENTR	
+00000	ENTR	
+00000	ENTR	

6.3.12.4 Test Analysis

6.3.12.4.1 Remove the strip charts from analog recorders

6.3.12.4.2 Examine each trace carefully to detect any sharp discontinuities of the traces. Disregard all transients less than 0.5 second (5 mm) on any Torque Motor Current signal.

6.3.12.4.3 No Torque Motor Current signal on (GG2140, GG2170, GG2110) shall ever exceed (0.125) amp. Sensitivity on recorder is 20 ma/division for GG2110, GG2140 and 36 ma/division for GG2170.

6.3.12.4.4 Each CDU Fine Error (GG2220, GG2280, GG2250) shall not exceed .070 volts steady state. Disregard transients.

6.3.12.4.5 No CDU Coarse Error (GG2221, GG2281, GG2251) shall ever exceed 0.680 volts.

6.3.13 Stabilization Loop Step Response Test

6.3.13.1 IG Response Test

6.3.13.1.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.13.1.2 On CRT, verify IG MG, and OG gimbal angles are between 358 and 002.

6.3.13.1.3 Set up analog recorder to monitor the following:

MEAS NO.	SIGNAL NAME
a. GG2110	IG Torque Motor Current
b. GG2106	IG Servo Error Total
c. GG2107	IG Servo Error In Phase
d. GG2112	IG 1X resolver Sine
e. GG2113	IG 1X Resolver Cosine
f. GG2220	IG CDU Fine Error
g. GG1201	IMU 28V 1 PCT 800 CPS

6.3.13.1.4 On K-148 initiate FINE ALIGN by entering the following sequence:

VERB 42 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.13.1.5 On the CRT verify CDU X, CDU Y and CDU Z indicate +00000±00200.

> CAUTION: If the transients caused by the subsequent step input do not damp out within 15 seconds, remove IMU Operate Power.

6.3.13.1.6 Enter 1000 into R-START 155.

6.3.13.1.7 Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the IG stabilization loop.

6.3.13.1.8 Prepare to start analog recorder at a chart speed of 100 mm/sec. (IG RESPONSE TEST)

6.3.13.1.9 Enter 0000 into R-START 155. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the IG stabilization loop.

6.3.13.1.10 After the transient on the recorder has died out, stop the recorder.

6.3.13.1.11 From the Servo Error In Phase signal recorder trace measure the time interval (T1, Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period T1, shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.

6.3.13.2 MG Response Test

6.3.13.2.1 Set up analog recorder to monitor the following:

	MEAS. NO.	SIGNAL NAME
a.	GG2136	MG Servo Error Total
b.	GG2137	MG Servo Error in Phase
c.	GG2140	MG Torque Motor Current
d.	GG2143	MG 1X Resolver Cosine
e.	GG2250	MG CDU Fine Error
f.	GG2142	MG 1X Resolver Sine
g.	GG1201	IMU 28V 1% 800 cps

6.3.13.2.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).

> CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU Operate power.

6.3.13.2.3 Enter 0100 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the MG stabilization loop.

6.3.13.2.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (MG RESPONSE TEST).

6.3.13.2.5 Enter 0000 into R-START 155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.

6.3.13.2.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.2.7 From the Servo Error In Phase signal recorder trace measure the time interval (T1 Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig 3). The period, T1, shall not exceed 0.1 seconds and the trace shall have no more than 3 overshoots.

6.3.13.3 OG Response Test

6.3.13.3.1 Set up analog recorder to monitor the following:

MEAS. NO.	SIGNAL NAME
a. GG2167	OG Servo Error In Phase
b. GG2170	OG Torque Motor Current
c. GG2166	OG Servo Error Total
d. GG2280	OG CDU Fine Error
e. GG2172	OG 1X Resolver Sine
f. GG2173	OG 1X Resolver Cosine
g. GG1201	IMU 28V 1% 800 cps

6.3.13.3.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).

> CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU operate power.

6.3.13.3.3 Enter 0010 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the OG stabilization loop.

6.3.13.3.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (OG RESPONSE TEST).

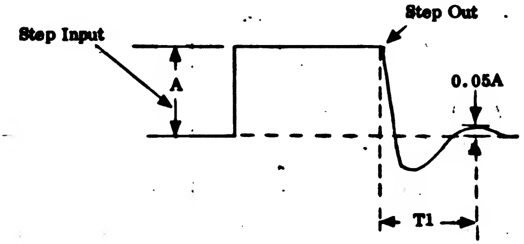
6.3.13.3.5 Enter 0000 into R-155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the OG stabilization loop.

6.3.13.3.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.3.7 From the Servo Error In Phase signal recorder trace, measure the time interval (T1, Fig 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig 3). The period, T1, shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.

6.3.13.3.8 On K-148 enter the following sequence:

VERB 41	NOUN 20	ENTR
+00000	ENTR	
+00000	ENTR	
+00000	ENTR	



TYPICAL STAB LOOP RESPONSE TO STEP INPUT

FIGURE 3

6.3.14 G&N Fine Alignment Test

6.3.14.1 On K-148 enter:

VERB 01 NOUN 10 ENTR
00003 ENTR

6.3.14.2 Record CRT, DSKY Row 1 display as AAAAA and the time of day.

6.3.14.3 On K-148 enter:

VERB 21 NOUN 01 ENTR
01300 ENTR
AAAAA ENTR
VERB 06 NOUN 02 ENTR
01300 ENTR

6.3.14.4 Record CRT DSKY Row 1 display as ±BBBBB

6.3.14.5 Perform the following calculations:

a. $\frac{\text{BBBBBX } 5.12}{3600} = \text{CCCC.C}$ Contents of high order scalar register in hours.

6.3.14.5.b Calculate the times of day at which the contents of the high order scalar will be at the following times.

2.91
5.82
8.73
11.64
14.55
17.46
20.37
23.30

6.3.14.6 If the time of day is within 12 minutes of any of those times calculated in 6.3.14.5.b when about to complete step 6.3.14.30 wait until that time has passed and then proceed.

6.3.14.7 On K-148 enter:

VERB 01 NOUN 01 ENTR
00370 ENTR
Record contents of DSKY Row 1 xxxxY
VERB 21 NOUN 01 ENTR
000370 ENTR
XXXXY' ENTR
Where Y' is obtained from Table 1a.
VERB 57 ENTR
00003 ENTR

6.3.14.8 Verify CRT DSKY display is:

VERB 06 NOUN 61 flashing
R1 = +13500 (SM Azimuth)
R2 = +40748 (Site Latitude)

NOTE: If R1 and R2 indications are correct proceed to step 6.3.14.10.

6.3.14.9 On K-148 enter:

VERB 21 ENTR
+13500 ENTR
VERB 22 ENTR
+40748 ENTR

6.3.14.10 On K-148 enter:

VERB 33 ENTR
Observe on CRT DSKY display
VERB 21 NOUN 30 (Flashing)

6.3.14.11 On K-148 enter:

0000X ENTR (Test position, either 1 or 2)
00000 ENTR (Use AOT)
Observe on CRT DSKY display:
VERB 06 NOUN 61 (Flashing)
Disregard Row 1, 2, and 3 indications

6.3.14.12 On K-148 enter:

VERB 21 ENTR
+XXX.XX ENTR (L tgt. true azimuth from 6.3.15.1.14)
VERB 22 ENTR
+XX.XXX ENTR (L tgt. elevation from 6.3.15.1.3)
VERB 23 ENTR
00001 ENTR (L tgt. number)
VERB 33 ENTR

Observe on CRT DSKY display:

VERB 06 NOUN 61 (Flashing)

Disregard Row 1, 2 and 3 indications.

6.3.14.13 On K-148 enter:

VERB 21 ENTR
+XXX.XX ENTR (F tgt. true azimuth from 6.3.15.1.14)
VERB 22 ENTR
+XX.XXX ENTR (F tgt. elevation from 6.3.15.1.12)
VERB 23 ENTR
00002 ENTR (F tgt. number)
VERB 33 ENTR

Observe on CRT DSKY display:
VERB 51 (flashing)
R1 = 00001

6.3.14.14 On Computer Control and Reticle Dimmer Assembly, press MARK X pushbutton. Observe on DSKY display:

VERB 21 NOUN 30 (Flashing)

6.3.14.15 On DSKY press ENTR

Observe on DSKY display:

VERB 21 NOUN 43 (Flashing)

6.3.14.16 On DSKY enter:

00001 ENTR (L Detent Code)
Observe on DSKY display
VERB 21 NOUN 42 (Flashing)

6.3.14.17 Set AOT to "L" position

6.3.14.18 Rotate AOT control knob until the center of the L tgt reticle is super imposed between the double Y reticle. Record AOT counter value as LY XXX.XX.

6.3.14.19 Rotate AOT control knob until the center of the L tgt reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as LS XXX.XX.

6.3.14.20 On DSKY enter:

±XXX.XX ENTR (value of LY)
Observe on DSKY display:
VERB 22 NOUN 42 (Flashing)

6.3.14.21 On DSKY enter:

±XXX.XX ENTR (Value of LS)
Observe on DSKY display:
VERB 51 (Flashing)
R1 = 00002

H

6.3.14.22 On Computer Control and Reticle Dimmer Assembly, press MARK X pushbutton. Observe on DSKY display:

VERB 21 NOUN 30 (Flashing)

6.3.14.23 On DSKY press ENTR. Observe on DSKY display:

VERB 21 NOUN 43 (Flashing)

6.3.14.24 On DSKY enter:

00002 ENTR (F Detent Code)
Observe on DSKY display:
VERB 21 NOUN 42 (Flashing)

6.3.14.25 Set AOT to "F" position

6.3.14.26 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double Y reticle. Record AOT counter value as FY XXX.XX.

6.3.14.27 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as FS XXX.XX.

6.3.14.28 On DSKY enter:

±XXX.XX ENTR (value of FY)
Observe on DSKY display:
VERB 22 NOUN 42 (Flashing)

6.3.14.29 On DSKY enter:

±XXX.XX ENTR (value of FS)

NOTE: Wait until DSKY display indicates VERB 51 (Flashing) R1 = 00001 before proceeding.

NOTE: Before completing step 6.3.14.30 check time of day to verify that the high order scalar will not overflow within the next 12 minutes.

6.3.14.30 Repeat steps 6.3.14.14 through 6.3.14.29.

6.3.14.31 In approximately 7 minutes, observe on CRT DSKY display and record.

VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Where number part of Y_{sm} misalignment about Z_{sm})
R2 = .XXXXX (Fractional number part of Y_{sm} misalignment about Z_{sm}.)

6.3.14.32 On K-148 enter.

VERB 33 ENTR
Observe on CRT DSKY display and record:
VERB 06 NOUN 66 (Flashing)

R1 = XXXXX (Whole number part of Z_{sm} misalignment about Y_{sm})
R2 = .XXXXX (Fractional number part of Z_{sm} misalignment about Y_{sm})

6.3.14.33 On K-148 enter:

VERB 36 ENTR
Press ERROR RESET

6.3.14.34 Repeat steps 6.3.14.7 through 6.3.14.30.

6.3.14.35 In approximately 7 minutes, observe on CRT DSKY display and record:

VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Whole number part of X_{sm} misalignment about Y_{sm})
R2 = .XXXXX (Fractional number part of X_{sm} misalignment about Y_{sm})

6.3.14.36 On K-148 enter:

VERB 33 ENTR
Observe on CRT DSKY display and record:
VERB 06 NOUN 66 (Flashing)
R1 = XXXXX (Whole number part of Y_{sm} misalignment about X_{sm})
R2 = .XXXXX (Fractional number part of Y_{sm} misalignment about X_{sm})

6.3.14.37 On K-148 enter:

VERB 36 ENTR
Press ERROR RESET
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.14.38 Results. The PIPA bias determined previously in the IMU Performance Test (6.3.9) must be subtracted from the resultant data of the test. The PIPA bias terms from paragraph 6.3.9 must be multiplied by a factor of 210 before performing the calculations in paragraphs 6.3.14.38.1 thru 6.3.14.38.4.

6.3.14.38.1 Y PIPA misalignment

R1 R2
About Z axis (from 6.3.14.31) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Y PIPA bias (from 6.3.9) = −(±XXXXX. XXXXX)$\widehat{\text{sec}}$
Y PIPA misalignment about Z axis = ——— . ——— $\widehat{\text{sec}}$
This value shall not exceed ±600 $\widehat{\text{sec}}$

6.3.14.38.2 Z PIPA misalignment

R1 R2
About Y axis (from 6.3.14.32) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Z PIPA bias (from 6.3.9) = −(±XXXXX. XXXXX)$\widehat{\text{sec}}$
Z PIPA misalignment about Y axis = ±——— . ——— $\widehat{\text{sec}}$
This value shall not exceed ±600 $\widehat{\text{sec}}$

6.3.14.38.3 X PIPA misalignment

R1 R2
About Y axis (from 6.3.14.35) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less X PIPA bias from (6.3.9) = −(±XXXXX. XXXXX)$\widehat{\text{sec}}$
X PIPA misalignment about Y axis = ±——— . ——— $\widehat{\text{sec}}$
This value shall not exceed ±600 $\widehat{\text{sec}}$

6.3.14.38.4 Y PIPA misalignment

R1 R2
About X axis from (6.3.14.36) = ±XXXXX. XXXXX $\widehat{\text{sec}}$
Less Y PIPA bias (from 6.3.9) = −(±XXXXX. XXXXX) $\widehat{\text{sec}}$
Y PIPA misalignment about X axis = ±——— . ——— $\widehat{\text{sec}}$
This value shall not exceed ±600 $\widehat{\text{sec}}$

6.3.15 AOT Functional Accuracy Test.

NOTE: Use of a Dioptometer is required when sighting through AOT. The included angles between target LOS shall be known to ±10 arc seconds. The elevation of each target LOS shall be known to ±15 arc seconds.

6.3.15.1 Insure that G&N System is in the Operate Mode.

6.3.15.2 On K-148 enter:

VERB 21	NOUN 03	ENTR
01462		ENTR
XXX.XX		ENTR (Detent L az data)
		ENTR
01463		ENTR
XXX.XX		ENTR (Detent F az data)
		ENTR
01464		ENTR
XXX.XX		ENTR (Detent R az data)
		ENTR
01465		ENTR
XXX.XX		ENTR (Detent L EL data)
		ENTR
01466		ENTR
XXX.XX		ENTR (Detent F EL data)
		ENTR
01467		ENTR
XXX.XX		ENTR (Detent R EL data)

6.3.15.3 Place the AOT in F detent position.

6.3.15.4 While viewing through the AOT instruct the target F operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target F until the center of the target reticle appears in the center of the AOT reticle.

6.3.15.5 Level the Theodolite base while assuring that the center of the target reticle remains in the center of the AOT reticle.

6.3.15.6 When it has been assured that the Theodolite is level and the target reticle appears in the center of the AOT reticle zero the F theodolite azimuth dial.

6.3.15.7 Place the AOT in the L detent position.

6.3.15.8 While viewing through AOT instruct the target L operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target L until the target reticle appears in the lower right quadrant of the AOT field of view.

6.3.15.9 Level the Theodolite base while assuring that the target reticle remains visible in the lower right quadrant of the AOT field of view.

6.3.15.10 When it has been assured that the Theodolite is level and the target reticle is visible, zero the L Theodolite azimuth dial.

6.3.15.11 Place the AOT in the R detent position.

6.3.15.12 While viewing through AOT instruct the target R operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target R until the target reticle appears in the lower left quadrant of the AOT field of view.

6.3.15.13 Level the Theodolite base while assuring that the target reticle remains visible in the lower left quadrant of the AOT field of view.

6.3.15.14 When it has been assured that the Theodolite is level and the target reticle is visible, zero the R theodolite azimuth dial.

6.3.15.15 Verify that target Theodolite L, F and R bases are level. Place the AOT in each Detent position from left to right and verify that each target reticle is still visible and in the proper field of view. If adjustments are required insure that the azimuth dial is rezeroed. Repeat this target scanning process until the AOT operator is satisfied with target placement.

6.3.15.16 AOT Measurement of X_1.

6.3.15.16.1 On K-148 enter:

VERB 57	ENTR
00012	ENTR

Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display.

6.3.15.16.2 On Computer Control and Reticle Dimming Assembly press MARK X pushbutton.

6.3.15.16.3 Observe VERB 21 NOUN 30 flashing on DSKY.

6.3.15.16.4 On DSKY enter:

00000		ENTR
Observe	VERB 21	NOUN 43 flashing
00001		ENTR
Observe	VERB 21	NOUN 42 flashing

6.3.15.16.5 Set AOT in L detent position.

6.3.15.16.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record as LY = XXX.XX.

6.3.15.16.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPRIAL lines of AOT reticle. Record AOT dial indication as LS XXX.XX.

6.3.15.16.8 Record target L Theodolite elevation angle from horizontal as ϕ_1.

6.3.15.16.9 On DSKY enter:

±XXX.XX		ENTR (LY from 6.3.15.16.6)
Observe	VERB 22	NOUN 42 flashing
±XXX.XX		ENTR (LS from 6.3.15.16.7)
Observe	VERB 51 flashing and R1 = 00002.	

6.3.15.16.10 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton.

30

6.3.15.16.11 Observe VERB 21 NOUN 30 flashing on DSKY.

6.3.15.16.12 On DSKY enter:

00000		ENTR
Observe	VERB 21,	NOUN 43 flashing
00002		ENTR
Observe	VERB 21,	NOUN 42 flashing

6.3.15.16.13 Set AOT in F detent position.

6.3.15.16.14 Rotate AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Record AOT dial indication as FY = XXX.XX.

6.3.15.16.15 Rotate the AOT control knob until the center of the target reticle is superimposed between the double S reticle lines. Record AOT dial indication as FS = XXX.XX.

6.3.15.16.16 Record target F Theodolite elevation angle from horizontal as ϕ_2.

6.3.15.16.17 On DSKY enter:

±XXX.XX		ENTR (FY from 6.3.15.16.14)
Observe	VERB 22	NOUN 42 flashing
±XXX.XX		ENTR (FS from 6.3.15.16.15)
Observe	VERB 06	NOUN 03 displayed
Record R1		

6.3.15.17 AOT Measurement of X2.

6.3.15.17.1 On K-148 enter:

VERB 57		ENTR
00012		ENTR
Observe	VERB 51 flashing and R1 = 00001 on CRT DSKY display.	

6.3.15.17.2 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton.

6.3.15.17.3 Observe VERB 21 NOUN 30 flashing on DSKY.

6.3.15.17.4 On DSKY enter:

00000		ENTR
Observe	VERB 21	NOUN 43 flashing
00001		ENTR
Observe	VERB 21	NOUN 42 flashing
±XXX.XX		ENTR (LY from 6.3.15.16.6)
Observe	VERB 22	NOUN 42 flashing
±XXX.XX		ENTR (LS from 6.3.15.16.7)
Observe	VERB 51	flashing and R1 = 00002.

6.3.15.17.5 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton.

6.3.15.17.6 Observe VERB 21, NOUN 30 flashing on DSKY.

6.3.15.17.7 On DSKY enter:

00000		ENTR
Observe	VERB 21	NOUN 43 flashing
00003		ENTR
Observe	VERB 21	NOUN 42 flashing

6.3.15.17.8 Set AOT in R detent position.

6.3.15.17.9 Rotate AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Record AOT dial indication as RY = XXX.XX.

6.3.15.17.10 Rotate AOT control knob until the center of the target reticle is superimposed between the double SPIRAL reticle lines. Record AOT dial indication as RS = XXX.XX.

6.3.15.17.11 Record target R theodolite elevation angle from horizontal as ϕ_3.

6.3.15.17.12 On DSKY enter:

±XXX.XX		ENTR (RY from 6.3.15.17.9)
Observe	VERB 22	NOUN 42 flashing
±XXX.XX		ENTR (RS from 6.3.15.17.10)
Observe	VERB 06	NOUN 03 displayed
Record R1.		

6.3.15.18 Theodolite measurement of X_1 and X_2.

6.3.15.18.1 Collimate Theodolite L and F. Read azimuth angle indicated by L Theodolite. Subtract angle from 360.00° and record as $\sphericalangle_1$. Read and record the azimuth angle indicated by F Theodolite as $\sphericalangle_2$.

6.3.15.18.2 Collimate Theodolite L and R. Read azimuth angle indicated by R Theodolite and record as α_3. Read and record the azimuth angle indicated by L Theodolite. Subtract angle from 360° and record as α'_1.

6.3.15.18.3 Calculate the values of the included angles between target L and F as X_1 and targets L and R as X_2.

$$X_1 = \mathrm{Cos}^{-1} \left\{ \sin \phi_1 \,\mathrm{Sin}\, \phi_2 + \mathrm{Cos}\, \phi_1 \,\mathrm{Cos}\, \phi_2 \,\mathrm{Cos} \left[(180 - (\alpha_1 + \alpha_2) \right] \right\}$$

$$X_2 = \mathrm{Cos}^{-1} \left\{ \sin \phi_1 \,\mathrm{Sin}\, \phi_3 + \mathrm{Cos}\, \phi_1 \,\mathrm{Cos}\, \phi_3 \,\mathrm{Cos} \left[(180 - (\alpha_3 + \alpha'_1) \right] \right\}$$

6.3.15.19 The angle recorded in 6.3.15.16.17 shall equal X_1 ±0.08°.

6.3.15.20 The angle recorded in 6.3.15.17.12 shall equal X_2 ±0.08°.

APPENDIX I

MEASUREMENT TOLERANCES

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY 1% OF FULL SCALE
GG 1020 link 4*	+14 vdc LGC Supply	14.0±0.4 vdc	0%
GG 1030 link 4	+4 vdc LGC Supply	4.0±0.2 vdc	0%
GG 1040 link 5**	+120 vdc PIPA Supply	120±6.0 vdc	1%
GG 1070 link 4	+4 vdc CDU Supply	4.0±0.2 vdc	0%
GG 1100 link 4	-28 vdc Supply	-27.5±6.0 vdc	0%
GG 1110 link 5	2.5 vdc Telemetry Bias No. 1	2.5±0.1 vdc	0%
GG 1201 link 5	IMU 28V 800 cps 1%	28±0.56V rms	1%
GG 1202 link 4	IMU 28V 800 cps 5%	28±1.4V rms	1.5%
GG 1203 link 4	IMU 28V 800 cps 5%	28±2.1V rms	1.5%
GG 1331 link 5	3.2 kc 28V Supply 1%	28.6±0.56V rms	1%
GG 1500 link 4	+28 vdc IMU Oper BUS	28.0 -3.5, +5.5 vdc	0%
GG 1510 link 4	+28 vdc IMU STBY BUS	28.0 -3.5, +5.5 vdc	0%
GG 1513X link 5	+28 vdc IMU STBY/OFF	28.0±1 vdc	0%
GG 1520 link 4	+28 vdc LGC Oper BUS	28.0 ±4.5,vdc. 5 vdc	0%
GG 1523X link 5	+28 vdc LGC Operate	28.0±1 vdc	0%
GG 2001 link 5	X PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2021 link 5	Y PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2041 link 5	Z PIPA S.G. OUT IN PH	+2.5±0.128V rms at 1g	3%
GG 2106 link 4	IG Servo Error Total	0.0±60 MV rms at null	1%
GG 2107 link 5	IG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2110 link 4	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2110 link 5	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2112 link 5	IG 1X Resolver Out-Sine	18.4±1.84V rms at 45°	2.5%
GG 2113 link 5	IG 1X Resolver Out-Cosine	18.4±1.84V rms at 45°	2.5%
GG 2121 link 5	IG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2136 link 4	MG Servo Error Total	0.0±60 MV rms at null	1%
GG 2137 link 5	MG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2140 link 4	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	0%
GG 2140 link 5	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque	1%
GG 2142 link 5	MG 1X Resolver Out-Sine	18.4±1.84V rms at 45°	2.5%
GG 2143 link 5	MG 1X Resolver Out-Cosine	18.4±1.84V rms at 45°	2.5%
GG 2151 link 5	MG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2166 link 4	OG Servo Error Total	0.0±60 MV rms at null	1%
GG 2167 link 5	OG Servo Error IN PH	0.0±60 MV rms at null	2%
GG 2170 link 4	OG Torque Motor Current	0.9 AMP Max during any fine Align Torque	0%
NG 1336 link 4	PH DIFF 3.2kc 28V/LGC SYNC	0° ±10°	3%

APPENDIX I (Continued)

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY % OF FULL SCALE
GG 2170 link 5	OG Torque Motor Current	0.9 AMP Max during any fine Align Torque	1%
GG 2172 link 5	OG 1X Resolver Out-Sine	18.4±1.84V rms at 45°	2.5%
GG 2173 link 5	OG 1X Resolver Out-Cosine	18.4±1.84V rms at 45°	2.5%
GG 2181 link 5	OG 1X Resolver Out-Sine 11°	5.35±0.27V rms at 11°	2%
GG 2219 link 5	Pitch Attitude Error	5.05±0.5V rms at 17°	1%
GG 2220 link 4	IG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2221 link 4	IG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2249 link 5	YAW Attitude Error	5.05±0.5V rms at 17°	1%
GG 2250 link 4	MG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2251 link 4	MG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2279 link 5	Roll Attitude Error	5.05±0.5V rms at 17°	1%
GG 2280 link 4	OG CDU Fine Error	0.0±0.07V rms at null	1%
GG 2281 link 4	OG CDU Coarse Error	0.0±0.68V rms at null	1%
GG 2300 link 5	PIPA Temperature	130.5±1.5°F in Operate	1%
GG 2301 link 4	IRIG Temperature	135±2.5°F in Operate	1%
GG 2301 link 5	IRIG Temperature	135±2.5°F in Operate	1%
GG 2302 link 4	IMU Heater Current On	28±1 vdc	0%
GG 2303 link 4	IMU Blower Current On	28±1 vdc	0%
GG 3304 link 5	RR Shaft 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3305 link 5	RR Shaft 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 3311 link 4	RR Shaft CDU Fine Error	0.0±0.07V rms at null	1%
GG 3312 link 4	RR Shaft CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3321 link 4	RR Trunnion CDU Fine Error	0.0±0.07V rms at null	1%
GG 3322 link 4	RR Trunnion CDU Coarse Error	0.0±0.68V rms at null	1%
GG 3324 link 5	RR Trunnion 1X Resolver Out-Sine	19.65±0.98V rms at 45°	2.5%
GG 3325 link 5	RR Trunnion 1X Resolver Out-Cosine	19.65±0.98V rms at 45°	2.5%
GG 4300 link 4	LGC Temperature	87.5±42.5°F	0%
GG 6020 link 4	PIPA Calibration Module Temperature	67.5±22.5°F	0%
GG 6020 link 5	PIPA Calibration Module Temperature	67.5±22.5°F	0%
GG 6021 link 4	PSA Temperature	85±25.0°F	0%

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT	PSAAM AND/OR SCA UNCERTAINTY OF FULL SCALE
NG1021 link 4	14 VDC LGC Noise RMS	0.4 VRMS Max	0%
NG1022 link 4	14 VDC LGC Noise Peak	5 volts with rise time of 2 to 5 usec	0%
NG1031 link 4	4 VDC LGC Noise RMS	0.4 VRMS Max	0%
NG1032 link 4	4 VDC LGC Noise Peak	5 volts with rise time of 2 to 50 used	0%
NG1071 link 4	4 VDC CDU Noise RMS	1.0 VRMS Max	0%
NG1072 link 4	4 VDC CDU Noise Peak	5 volts with rise time of 2 to 50 usec	0%
NG1501 link 4	28 VDC IMU Operate Noise RMS	1.0 VRMS Max	0%
NG1502 link 4	28 VDC IMU Operate Noise Peak	5 volts with rise time of 2 to 50 usec	0%
NG1511 link 4	28 VDC IMU Standby Noise RMS	1.0 VRMS Max	0%
NG1512 link 4	28 VDC IMU Standby Noise Peak	5 volts with rise time of 2 to 50 usec	0%
NG1521 link 4	28 VDC LGC Operate Noise RMS	2.0 VRMS Max	0%
NG1522 link 4	28 VDC LGC Operate Noise Peak	5 volts with rise time of 2 to 50 usec	0%

*Link 4 - PSAAM Output Signal
**Link 5 - SCA Output Signal

ADDENDUM 1

LM-1 and LM-2

ADDITION 1: The following procedure will be performed for LM-1 and LM-2 only.

6.3.16 Gyrocompassing Test

6.3.16.1 Insure that the IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.16.2 On K-148 enter the following sequence:

VERB 57	ENTR
00006	ENTR

6.3.16.3 VERB 06 NOUN 61 shall flash.

6.3.16.4 The CRT, DSKY display shall display Launch Azimuth. (Launch Azimuth shall be the GAEC Navigator Base Azimuth defined by GAEC).

6.3.16.5 If value for Row 1 is correct, proceed to the next step. If value for Row 1 is incorrect, enter the following into K-148:

VERB 21	ENTR
±XXXXX	ENTR Correct launch azimuth (GAEC Nav Base Az)

Verify value in Row 1 is correct.

6.3.16.6 On K-148 enter the following:

VERB 33	ENTR

6.3.16.7 VERB 06 NOUN 61 shall flash.

6.3.16.8 The CRT, DSKY display shall display Navigation Base Azimuth and Latitude, respectively.

6.3.16.9 If the values for Row 1 and Row 2 are correct, proceed to the next step. If the values for Row 1 or Row 2 are incorrect, enter the following into K-148.

If Row 1 is incorrect: VERB 21 ENTR
±XXXXX ENTR (Correct Nav Base Azimuth)

If Row 2 is incorrect: VERB 22 ENTR
+40.748 ENTR (Correct Site Latitude)

Verify values for Row 1 and Row 2 are correct.

6.3.16.10 On K-148 enter the following:

VERB 33 ENTR
VERB 16 NOUN 20 ENTR

6.3.16.11 One hour after step 6.3.16.10 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.16.12 Obtain and record the latest measured value of the following data.

6.3.16.12.1 NBDX

6.3.16.12.2 NBDY

6.3.16.12.3 NBDZ

6.3.16.12.4 ADIAZ

6.3.16.12.5 ADSRAY

6.3.16.12.6 GAEC NB YZ plane about Z local vertical.

6.3.16.12.7 GAEC NB YZ plane about Y local vertical.

6.3.16.13 Calculate the vertical and east IRIG coefficient drift contribution to azimuth error (ϕ Vert).

a. Drift (vert) = NBDZ+ADIAZ = ________________ meru

b. Drift (east) = NBDX sin α +NBDY sin (α + 90) + ADSRAY sin (α + 90)
Where α = Launch Azimuth

c. ϕ vert = $\frac{6.65a + 272b}{3600}$ = ______________ degrees

6.3.16.14 Algebraically add φ (vert) from the Row 1 DSKY display recorded in 6.3.16.11. The resultant azimuth error shall be 000.00±000.57 degrees.

6.3.16.15 Algebraically subtract the value recorded in 6.3.16.12.6 from the Row 3 DSKY display recorded in 6.3.16.11. The resultant vertical error about Z local vertical shall be 000.00±000.06 degrees.

6.3.16.16 Algebraically subtract the value recorded in 6.3.16.12.7 from the Row 2 DSKY display recorded in 6.3.16.11. The resultant vertical error about Y local vertical shall be 000.00±000.06 degrees.

6.3.16.17 Two hours after 6.3.16.10 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.16.18 The CRT DSKY display of Row 1 shall be within 000.06 degrees of the value recorded in 6.3.16.11. The CRT DSKY display of Row 2 and Row 3 shall be within 000.03 degrees of the respective values recorded in 6.3.16.11.

6.3.16.19 On K-148 enter the following:

VERB 36		ENTR
VERB 40	NOUN 20	ENTR
+00000		ENTR
+00000		ENTR
+00000		ENTR

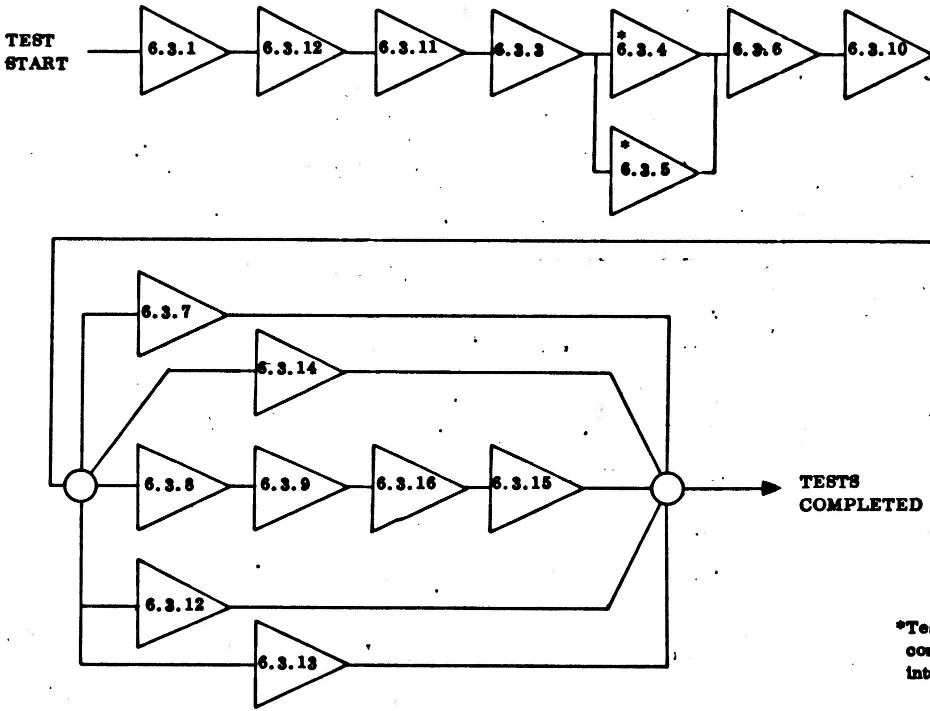
ADDENDUM 1

LM-1 and LM-2

Addition 2: Perform LM-1 and LM-2 test in accordance with the following Flowgram.

Addition 3: Place a note after paragraph 6.3.1.6.2.

NOTE: If the LMP Interlock CB is energized insure that the ATCA switch on LEM Panel 16 and the ATCA/PGNCS switch on Panel 11 are in the off position before performing the following steps.



*Tests may be performed concurrently on a non-interference basis

TEST PROCEDURE FLOWGRAM

FIGURE 1

ADDENDUM II
AURORA 85

Following are the changes required to make this document applicable for checkout of a G&N System with an Aurora 85 Test Rope.

Addition 1. Paragraph 6.3.7 PGNCS Operational Test

a. Delete paragraphs 6.3.7.15.2 and 6.3.7.15.3

b. Subtract an Octal 1 from each of the NOUN display requirements in paragraphs 6.3.7.20.1, 6.3.7.20.3, 6.3.7.20.5, 6.3.7.20.7, 6.3.7.20.9, 6.3.7.20.11 and 6.3.7.20.13.

Addition 2. Paragraph 6.3.8 IRIG Scale Factor Test

a. Change Paragraph 6.3.8.22 to read as follows:

The average of the three readings of Scale Factor Error for each of the 6 positions shall be 556±1750 PPM.

Addition 3. Paragraph 6.3.9 IMU Performance Test.

a. Add the following note prior to step 6.3.9.22.

NOTE: Paragraph 6.3.9.24 must be performed within one minute after VERB 06 and NOUN 66 flash in paragraph 6.3.9.23. In the event a PROG alarm is obtained enter VERB 36, press the ENTR pushbutton and repeat paragraphs 6.3.9.8 through 6.3.9.24.

b. Add the following note prior to step 6.3.9.36.

NOTE: Paragraph 6.3.9.39 must be performed within one minute after VERB 06 and NOUN 66 flash in paragraph 6.3.9.38. In the event a PROG alarm is obtained enter VERB 36, press ENTR and repeat paragraphs 6.3.9.8 through 6.3.9.1. Enter the following in K-148.

VERB 25	ENTR
+00600	ENTR
+00000	ENTR
+00003	ENTR

Repeat paragraphs 6.3.9.28 through 6.3.9.39.

6.3.17.4.4 On K-148 enter the following:

Press ERR RST
VERB 36 ENTR
VERB 41 NOUN 40 ENTR
+00000 ENTR
+03375 ENTR
VERB 34 ENTR
VERB 21 NOUN 10 ENTR
00012 ENTR
00001 ENTR

Verify RR CDU Fail comes ON in approximately 90 seconds.

ADDENDUM III RR INTERFACE

LTA-8, (MSC) - LM-3 and Subsequent

RR CDU testing requires that the Rendezvous Radar is operating. The Rendezvous Radar is not activated until Integrated testing. To insure that the RR CDU's are operating properly the minimum requirements for RR CDU testing are presented here so that they may be included as part of the requirements to be demonstrated at the first opportunity after Rendezvous Radar activation.

6.3.17 RR/CDU Control

6.3.17.1 Command Accuracy 24000°

6.3.17.1.1 On K-148 enter the following

VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+24000		ENTR
+24000		ENTR
VERB 34		ENTR

The CRT RR CDU Trunnion and Shaft angle indications shall be 240.00±000.30°.

6.3.17.2 CDU Fine and CDU Coarse Error

6.3.17.2.1 Set up analog recorder to monitor the following:

Meas. No.	Signal Name
a. GG3311	Shaft CDU Fine Error
b. GG3312	Shaft CDU Coarse Error
c. GG3321	Trunnion CDU Fine Error
d. GG3322	Trunnion CDU Coarse Error

6.3.17.2.2 On K-148 enter the following:

VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+04500		ENTR
+04500		ENTR
VERB 34		ENTR

6.3.17.2.3 Verify the following signals on the CRT.

RR Shaft 1X Sin (GG3304)	18.4±1.84 VRMS
RR Shaft 1X Cos (GG3305)	18.4±1.84 VRMS
RR Trunnion 1X Sine (GG3324)	18.4±1.84 VRMS
RR Trunnion 1X Cos (GG3325)	18.4±1.84 VRMS

6.3.17.2.4 Verify that no CDU Fine Error (GG3311, GG3321) exceeds .070 volts.

6.3.17.2.5 Verify that no CDU Coarse Error (GG3312, GG3322) exceeds .680 volts.

6.3.17.3 Deleted.

6.3.17.3.1 Deleted.

6.3.17.3.2 Deleted.

VERB 40 NOUN 40 ENTR

Wait 10 seconds then record the CRT RR CDU Trunnion and Shaft indications; the recorded value shall be within ±000.01° of the value recorded above.

6.3.17.4 RR CDU Fail

6.3.17.4.1 On K-148 Enter the following:

VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+00100		ENTR
+00000		ENTR
VERB 34		ENTR
VERB 21	NOUN 10	ENTR
00012		ENTR
00001		ENTR

Verify RR CDU Fail comes ON in approximately 10 seconds.

6.3.17.4.2 On K-148 enter the following:

Press ERR RST

VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+00000		ENTR
+00100		ENTR
VERB 34		ENTR
VERB 21	NOUN 10	ENTR
00012		ENTR
00001		ENTR

Verify RR CDU Fail comes ON in approximately 10 seconds.

6.3.17.4.3 On K-148 enter the following:

Press ERR RST		
VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+03375		ENTR
+00000		ENTR
VERB 34		ENTR
VERB 21	NOUN 10	ENTR
00012		ENTR
00001		ENTR

Verify RR CDU Fail comes ON in approximately 10 seconds.

6.3.17.4.4 On K-148 enter the following:

Press ERR RST		
VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+00000		ENTR
+03375		ENTR
VERB 34		ENTR
VERB 21	NOUN 10	ENTR
00012		ENTR
00001		ENTR

Verify RR CDU Fail comes ON in approximately 10 seconds.

6.3.17.4.5 On K-148 enter the following:

Press ERR RST		
VERB 36		ENTR
VERB 41	NOUN 40	ENTR
+00000		ENTR
+00000		ENTR
VERB 34		ENTR

ADDENDUM IV

LM-4 and Subsequent Spacecraft Measurement Deletions

Addition 1:	**Delete last sentence of Paragraph 6.3.4.2.**
Addition 2:	**Delete last two sentences of Paragraph 6.3.4.3.**
Addition 3:	**Delete Paragraphs 6.3.7.23 and 6.3.7.24.**
Addition 4:	**Change Paragraph 6.3.7.25 to read as follows:**

6.3.7.25 **On K-148, enter the following:**

VERB 36	**ENTR**
VERB 41 NOUN 20	**ENTR**
+00000	**ENTR**
+00000	**ENTR**
+00000	**ENTR**

APOLLO G&N Specification
ND 1002323

Original Issue Date:
Release Authority: TDRR 31026
Class Release

POST-INSTALLATION CHECKOUT SPECIFICATION
FOR LEM GUIDANCE AND NAVIGATION SYSTEM

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised

This specification consists of page 1 to 83 inclusive.

APPROVALS	NASA/MSC				ACED 9/13/62

1. INTRODUCTION

1.1 The individual Spacecraft (SC) installed Guidance and Navigation (G&N) System to be checked out per the process specification shall consist of one of each of the following major assemblies. Refer to drawing 6015000 for specific system dash numbers effectivities.

Assembly Name	Part Number
1 - Apollo Guidance Computer Group	6003001-XXX
1 - Inertial Meas. Unit & Pulse Torque Assembly	6007001-XXX
1 - Coupling Data Unit	2007222-XXX
1 - Power and Servo Assembly	6007200-XXX
1 - Computer Control & Reticle Dimmer Assembly	6014512-XXX
1 - G&N Interconnect Harness Assembly (LEM)	6014515-XXX
1 - Signal Conditioner Assembly	
1 - Navigation Base Assembly (LEM)	6899950-XXX
1 - Alignment Optical Telescope (LEM)	6011000-XXX

1.2 The G&N System herein shall be identified as Part #6015000. The computer contains the AURORA program test ropes in the core rope memory.

2. SCOPE

2.1 This specification outlines the checkout requirements for G&N System installed in a LEM VEHICLE. Addendum to this specification will cover any special checkout requirements associated with individual vehicles and G&N Systems.

3. APPLICABLE DOCUMENTS

3.1

Document Number	Date	Subject
LIS-540-10001	02 Aug 65	LEM-PGNS Functional Interface
LID-340-10000	30 July 65	ICD-PGNS (LGC-CDU-PSA and Sig. Cond.) Instl.
LID-340-10010	30 July 65	ICD-LEM DSKY Installation
LID-280-10004	30 July 65	ICD-IMU-AOT-NVB-PTA Installation
LID-390-10001	30 July 65	ICD-LEM Wiring Electrical Interface for PGNS
LID-540-10001	4 June 65	ICD-LEM-PGNS Functional Interface Flow Diagram
LIS-510-10001	30 July 65	Thermodynamic Requirements of Guidance & Navigation Equipment - GAEC
LIS-520-10001	27 July 65	LEM Design Environment
LIS-350-10002	29 July 65	LEM-PGNS Lateral and Forward Velocity Interface
LIS-370-10007	29 July 65	LEM PGNS 800 CPS Power Electrical Interface
LIS-370-10003	2 Aug 65	LEM-PGNS Measurement Interface
LIS-370-10004	29 July 65	LEM-LGC Electrical Interface
LIS-390-10002	02 Aug 65	Guidance and Navigation Prime Power Requirements and Characteristics
LID-410-10002		ICTC System Interface
LID-410-10003		PSA Adapter Module Interface

4. Material and Equipment

4.1 The following test equipment shall be used to perform the requirements of this specification. If protection to personnel and equipment is not decreased, items, except government furnished parts, equivalent to those listed may be used.

ITEM	DESCRIPTION	MODEL NO.
1	Water Conditioner and Transfer Unit	430-5030
2	Vehicle Ground Power Supply	410-82140-1
3	Data Acquisition System	410-9700
4	ACE - S/C Ground Station	410-11990-1
5	Carry-On Cable Set	410-11170
6	10 Volt Power Supply PCMTEA	410-72021
7	Carry On PCM System	410-92210-3
8	Digital Signal Conditioner and Multiplex Unit C-O	410-92211
9	Analog Signal Conditioner and Sample Unit C-O	410-92212
10	General Signal Conditioner and Switch Matrix Unit C-O	
11	Data Interleaver System, Miniaturized	410-92232
12	Service Equipment Adapter ACE	410-92240
13	Digital CMB System Service Equipment	410-92241
14	ACE - S/C Support Platform	420-73100
15	Junction Box - 4 units	410-12731
16	Intercom Cable Set	410-0110
17	Intercom Patch Panel	410-09450
18	Intercom Rack Mounted	410-09470-1
19	Intercom Rack Mounted	410-09470-3
20	Intercom Power Supply	410-09472
21	Intercom Test Cord	410-09480
22	GAEC Test Facility Cable Set	410-11090-15
23	ACE - S/C GSE DC Power Supply	410-11270
24	D/S Signal Conditioner Unit	419-92484
25	PSA Adapter	410-31080
26	Portable Temperature Controller	410-31058
27	Breakout Box	410-1210-1
28	Electronic Counter	HP-5245L
29	Plug In Preset Unit	HP-5264A
30	5 Place Sine-Cosine Tables, Friden Calculator	
31	Diaptometer	

5. GENERAL REQUIREMENTS

5.1 Safety Requirements

5.1.1 Operator Safety

5.1.1.1 Normal safety precautions shall be observed through the G&N post-installation checkout.

5.1.2 Equipment Safety

5.1.2.1 To preserve the operational life of the components of the G&N hardware under test, settings and adjustments shall be performed only when specified in the test procedure. Care shall be exercised in the accomplishment of all settings and adjustments to avoid excessive wear or damage to the equipment. All precautionary measures stated throughout the test procedures shall be strictly adhered to.

5.1.2.2 Prior to the electrical connection of the G&N System to the spacecraft harness, a complete verification of spacecraft power, including both voltage polarity as well as magnitude, shall be completed to preclude damage to the G&N due to incorrect power application.

5.1.2.3 The connection between the Portable Temperature Controller (PTC) and 56J1 shall be maintained unless otherwise specified.

5.1.2.5 The temperature of the inertial components shall be maintained between the following limits. If these limits are exceeded, the inertial components shall be recalibrated.

a. IRIG: 120 Deg F and 150 Deg F

b. PIP: 115 Deg F and 145 Deg F

5.1.2.5 All personnel concerned shall thoroughly understand the Operational Requirements in Section 6.2 to preclude any damage to the G&N System.

5.2 Standard Environmental Conditions

5.2.1 The G&N System shall be tested under Class 100, 000 conditions as specified in Federal Standard No. 290 while installed and operating in the LEM, except as noted below.

5.2.1.1 For periods of G&N testing with the AOT uncovered, the environment shall meet at least the Class 100,000 specification for particle size and count. (No more than 100,000 particles 0.5 micron or larger per cubic foot with no more than 700 particles 5.0 microns or larger per cubic foot.)

5.2.1.2 With the optical heads covered and the eyepieces installed or covered on the AOT, the ambient environment shall meet the following conditions for particle size and count. No more than 200,000 particles 0.5 micron or larger per cubic foot with no more than 1400 particles 5.0 microns or larger per cubic foot.

5.2.2 Coolant Requirements

5.2.2.1 When electrical power is applied to the G&N System, the IMU shall be provided with water-glycol coolant at a temperature of 40±3 Deg F and a flow rate of 33±5 pounds per hour.

5.2.2.2 The PSA, CDU, and PTA cold plates shall be provided with coolant as per ICD LIS-510-10001.

5.3 Test Equipment Tolerances

5.3.1 Appendix 1 to this specification lists tolerances for those signals called out on the LEM Baseline measurements list. The tolerances provided are those to which the system is tested in the G&N LAB.

There are two categories of signals provided to ACE by the G&N System.

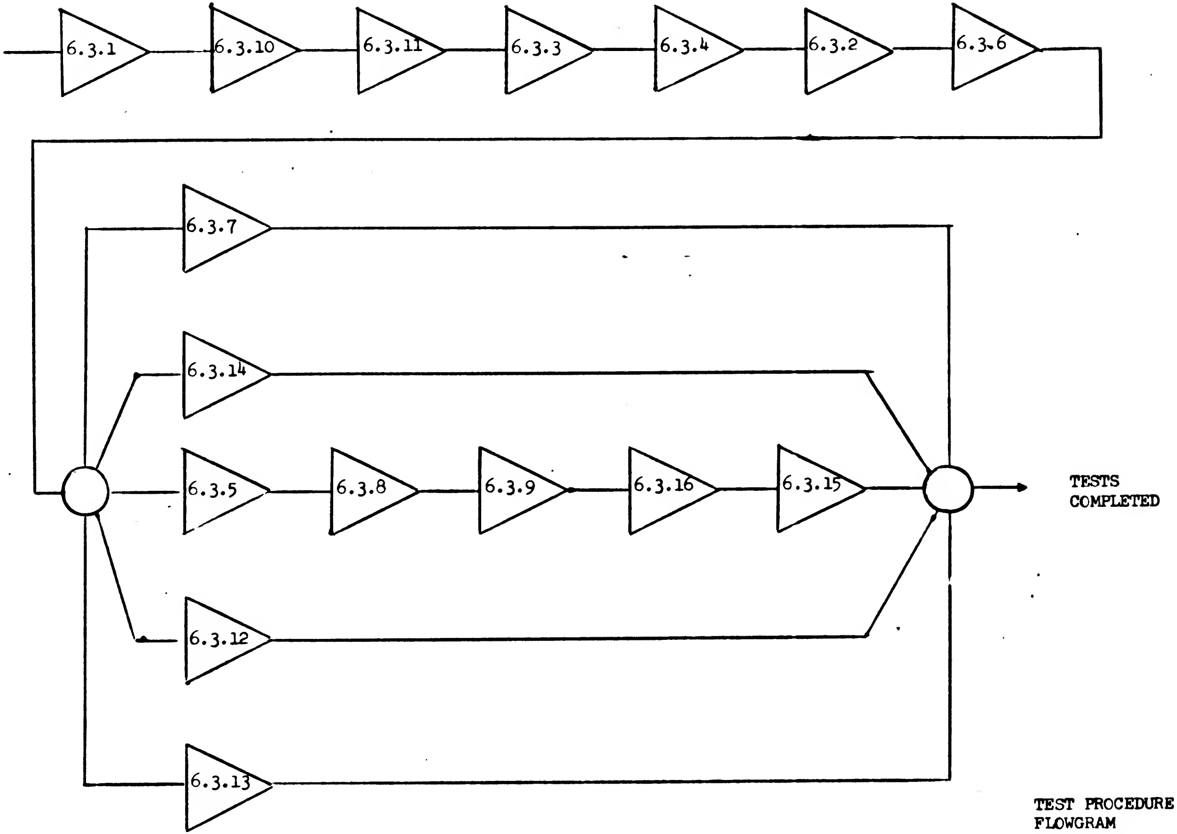
a. Signal conditioner output signals

b. PSAAM output signals.

Six point calibration data is provided for all signal conditioner and PSAM outputs. Since the calibration data can be referenced, no additional error source is attributed to the signal conditioner or the PSAAM.

5.3.2 In the event of a conflict between requirements, the following order of precedence shall apply. The contractor shall also notify AC Electronics Site Manager. of the conflict..

a. The contract
b. This specification
c. Documents referenced in this specification



TEST PROCEDURE
FLOWGRAM
FIGURE 1

5.4 Test Sequence

5.4.1 The test sequence shall normally follow the flow gram in figure 1. Any test subsequent to Temperature Control Verification Section 6.3.4 may be conducted providing the General Turn On Procedure 6.2.4 is followed.

5.5 The generation of a noise alarm indication, as evidenced by one or more Noise Peak Event lamps becoming lighted shall be cause for immediate determination of effects on the G&N system test in progress. In the event of detrimental effects on the system test a troubleshooting routine shall be entered to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.

5.6 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N System as non-conforming. Normal test sequence may be continued upon determination of the cause of the non conformance or at the discretion of the G&N contractor test team if it is determined that such action is not detrimental to the G&N System or other interfacing subsystems. All non conformances shall be investigated and cleared by waivers (F.N.N.), correction of specification, or hardware replacement and retest. The suspected malfunctioned hardware shall be removed and returned to the laboratory wwhere the malfunction shall be verified. Only after malfunction verification shall a flight certified replaceable element be installed in the G&N System.

5.7 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps pertaining directly to the G&N components. If any questions arise concerning the test equipment, the Test Conductor should refer to the respective operational manuals.

5.8 Spacecraft systems other than the G&N System may be operating on a noninterfering basis while individual system checkout of the G&N is being conducted.

5.7 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance readings shall be recorded and flagged by appropriate signals.

Paragraph No.	Test Title
6.3.1	Standby Power In Test
6.3.2	Alarms and Interrupts Test
6.3.3	IMU Operate Power On Test
6.3.4	Temperature Control Verification
6.3.5	PGNCS Power Supply Test
6.3.6	IMU Operational Test
6.3.7	PGNCS Operational Test
6.3.8	IRIG Scale Factor Test
6.3.9	IMU Performance Test
6.3.10	LGC Voltage Margin Test
6.3.11	LGC Clock Frequency Test
6.3.12	Gimbal Friction Test
6.3.13	Stabilization Loop Response Test
6.3.14	Gyrocompassing Test
6.3.15	G and N Fine Alignment Test
6.3.16	AOT Functional Performance Test

TEST SEQUENCE

Figure 1a

6. DETAILED REQUIREMENTS

6.1 Initial Test Conditions

6.1.1 The IMU shall be supplied with heater power on a continuous basis. The Portable Temperature Controller (Model No. 410-31058) shall be connected at all times although heater power may be supplied from the +28VDC IMU STANDBY buss and monitored through ACE.

6.1.2 The IMU shall never be without heater power longer than 15 minutes.

6.2 Operational Requirements

6.2.1 Emergency Shutdown Procedure

CAUTION

In the event of any malfunction which might damage the G&N System before the normal shutdown procedure in 6.2.2 can be performed, power shall be removed from the G&N System as soon as possible. If at all possible, without creating any delay, IMU Operate power should be removed first.

6.2.2 Normal Shutdown Procedure

6.2.2.1 The normal shutdown of a G&N System shall include parking the gimbals prior to removing IMU Operate Power. This is accomplished in the following procedure.

6.2.2.2 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+09000 ENTR

6.2.2.3 On the CRT, page 16, line 20, verify the following platform angles are displayed:

IG is between 358 and 002
MG is between 088 and 092
OG is between 358 and 002
Verify Gimbal Lock Lamp is lit.

6.2.2.4 Pull out +28 VDC IMU OPERATE circuit breaker (4CB124) on LEM Cabin Panel XI to remove IMU OPERATE power.

6.2.2.5 Pull out +28VDC IMU STANDBY circuit breaker (4CB161) on LEM Cabin Panel XI to remove IMU STANDBY power.

6.2.2.6 Pull out +28VDC LGC OPERATE circuit breaker (4CB122) on LEM Cabin Panel XI to remove LGC OPERATE power.

6.2.3 Initial Turn-On Procedure

6.2.3.1 Proper coolant flow shall be verified prior to application of any power to the G&N System.

6.2.3.2 The initial power turn-on sequence shall be in the order specified in the test procedures (6.3) observing all cautions and delays as specified.

6.2.4 General Turn-On Procedure

6.2.4.1 This step shall be effective only after having completed the initial turn-on procedures..

6.2.4.2 Proper coolant flow shall be verified.

6.2.4.3 Depress +28VDC LGC OPERATE circuit breaker (4CB122) on LEM Cabin Panel 11 to supply LGC Operate power.

6.2.4.4 Depress STBY pushbutton on DSKY for 3 seconds and verify STBY light on DSKY is off.

6.2.4.5 Depress +28VDC IMU STANDBY circuit breaker (4CB161) on LEM Cabin Panel 11 to supply IMU STANDBY power.

6.2.4.6 On K-148 enter the following sequence:

```
ERROR RESET
VERB 36 ENTR  (fresh start)
VERB 57 ENTR
00015   ENTR  (clear erasable memory)
VERB 21 NOUN 27 ENTR
77777   ENTR  (LGC Self Check)
```

6.2.4.7 On the CRT, page 15 line 12, verify that the 3.2KC 28V Supply indicates between 28.04 and 29.16VRMS (GG 1331).

6.2.4.8 On the CRT, page 20, verify that R1 does not display 01102 or 41102 (indicating a malfunction).

6.2.4.9 After 5 minutes, stop LGC Self Check by entering the following in K-148:

```
VERB 21 NOUN 27 ENTR
     0 ENTR
```

6.2.4.10 CAUTION: LGC OPERATE AND IMU STANDBY power must have been applied a minimum of two hours before energizing the IMU OPERATE circuit breaker in step 6.2.4.16 unless all of the following conditions are met:

IF: 1. The G&N System has previously been in Standby Mode at least two hours and subsequently been in Operate Mode, AND

2. The gimbals were placed in a parked position prior to shutdown, AND

3. The shutdown period did not exceed 5 days, AND

4. The Spacecraft or IMU have not been moved in any way during the shutdown period.

THEN: The two-hour standby Mode operation requirement is reduced to 90 seconds.

6.2.4.11 The G&N System is defined as being in Standby Mode when LGC Operate and IMU Standby power is applied and IMU Operate power is off. The inertial components shall have suspension power in Standby Mode.

6.2.4.12 The G&N System is defined as being in Operate Mode when LGC OPERATE, IMU STANDBY and IMU Operate Power is applied to the system.

6.2.4.13 Set up analog recorder 4A1A3 to monitor the following signals:

	Channel	Switch Pos.	Signal No.	Signal Name
a.	1	3	GG 2137	MG Servo Error Total
b.	2	1	GG 2106	IG Servo Error Total
c.	3	2	GG 2166	OG Servo Error Total
d.	4	1	GG 2112	IG 1X Resolver Sine
e.	5	2	GG 2172	OG 1X Resolver Sine
f.	6	3	GG 2142	MG 1X Resolver Sine
g.	7	1	GG 1201	IMU 28V 1φ 800 CPS
h.	8		Spare	

6.2.4.14 Start the analog recorder 4A1A3 to a chart speed of 5 mm/sec. Start event recorder 4A2A2 to a chart speed of .10 mm/sec. (10/100 mm/sec.).

6.2.4.15 On CRT, page 15, line 1, monitor +120 VDC PIPA SUPPLY (GG1040) and on page 16, line 20 monitor platform angles.

6.2.4.16 Press in +28VDC IMU OPERATE circuit breaker (4CB124) on LEM Cabin Panel 11.

6.3.1.4.5 On CRT, page 15 line 23, the +4VDC LGC SUPPLY (GG 1030) shall indicate between 3.85 and 4.15 VDC. Record this value.

6.3.1.5 IMU Standby Power Turn On

6.3.1.5.1 Turn on Event Recorder 4A2A2 to a speed of .10 mm/sec. (10/100 mm/sec).

6.3.1.5.2 Press in +28VDC IMU STANDBY circuit breaker (4CB161) on LEM Cabin Panel XI. Record time.

6.3.1.5.3 Verify on channel 11 of 4A2A2 that +28 VDC IMU STANDBY power discrete (GG 1513) is on. On CRT, page 15 line 7, +28V IMU STANDBY Buss (GG 1510) shall indicate between 24.5 and 33.5.

6.3.1.5.4 On CRT, page 15 line 12, the 28V 3200 CPS SUPPLY (GG 1331) shall indicate between 28.04 and 29.16 VRMS. Record this value.

6.3.1.5.5 The PIPA TEMP displayed on CRT, page 16, line 9, shall be monitored periodically for one hour to ensure that the PIPA Temperature Control circuitry is operating to maintain a temperature of 130 ± 5.0 DEG F. (GG 2300) Two hours after performing step 6.3.1.5.2 record PIPA TEMP, CRT page 16 line 9.

6.3.1.6 LGC Operational Tests

6.3.1.6.1 DSKY Check

6.3.1.6.1.1 Initiate the DSKY check by entering in the DSKY:
VERB 57 ENTR 0015 ENTR (clear eraseable memory)
VERB 21 NOUN 27 ENTR
00011 ENTR

6.3.1.6.1.2 All the electroluminescent elements (PROG, VERB, NOUN and Row 1, Row 2, Row 3) shall display the decimal number nine (9). Including the 9's, the following shall be displayed for approximately 5 seconds.

a. 9's
b. 8's
c. 7's
d. 6's
e. 5's
f. 4's
g. 3's
h. 2's
i. 1's
j. 0's
k. Minus signs in Row 1, ROW 2, ROW 3 } On concurrently for 5 seconds
l. VERB-NOUN Flashing
m. COMP ACTY
o. Plus signs in ROW 1 } On concurrently for 5 seconds
p. VERB-NOUN Flashing
q. COMP ACTY
r. COMP ACTY - On for 5 seconds then DSKY blanks.

6.2.4.17 Verify on analog recorder 4A1A3 that the oscillations of the resolver sine signals (GG 2112, GG 2172 and GG2142) are not sustained and that the signals null out within 10 seconds. If this condition is not attained, remove IMU OPERATE power immediately.

6.2.4.18 On the CRT, page 15, line 1, verify absence of +120 VDC PIPA SUPPLY voltage for 90 ±10 seconds after step 6.2.4.16 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.2.4.16.

6.2.4.19 Verify absence of LGC WARNING, ISS WARNING, and PGNCS CAUTION lights in the LEM cabin.

6.2.4.20 On the CRT, page 16, line 20, verify all platform angles indicate between 358 and 002.

6.2.4.21 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.2.4.22 On the CRT, page 15, scan the power supply voltages to verify their normal operation.

6.2.4.23 After all the tests of 6.3 in Table I have been completed, the General Turn-On Procedure (6.2.4) and IMU Operational Test (6.3.6) shall be completed before re-running any test. Other wise, the testing sequence shall continue in accordance with Table I.

6.2.5 Interruption of Power

6.2.5.1 After the system has been operating with IMU Operate power on, and a power interruption occurs for a duration not exceeding 15 minutes, a minimum of 90 seconds operation in Standby Mode is required before resuming IMU Operate power. If the power interruption was longer than 15 minutes, the G&N System shall be run in Standby Mode for a time interval at least equal to the duration power was off before resuming IMU Operate power. However, this period need not exceed two hours before application of IMU Operate power.

6.3.1.3 The following switches and/or circuit breakers shall be closed to energize the indicated busses.

LOCATION	NOMENCLATURE	IDENTIFICATION
Panel 14	BAT 5 NORMAL FEED	4S10
Panel 14	BAT 6 NORMAL FEED	4S11
Panel 16	X LUNAR BUS TIE	4CB5
Panel 16	BAT 1-4-6 FEED TIE	4CB17
Panel 16	BAT 2-3-5 FEED TIE	4CB25
Panel 16	ASC ECA	4CB14
Panel 16	ASC ECA CONT.	5CB7
Panel 16	DC BUS VOLT	4CB21
Panel 16	DISP.	4CB16
Panel 11	X LUNAR BUS TIE	4CB4
Panel 11	BAT 1-4-6 FEED TIE	4CB18
Panel 11	BAT 2-3-5 FEED TIE	4CB26
Panel 11	ASC ECA	4CB15
Panel 11	ASC ECA CONT.	4CB6
Panel 11	DC BUS VOLT	4CB22
Panel 16	INV. NO 2	4CB13
Panel 14	AC PWR to INV 2 Position	4S14
Panel 11	AC BUSS FEED TIE	4CB24
Panel 11	AC BUS VOLT	4CB27

6.3.1.4 Computer Power Turn On

6.3.1.4.1 Press in +28VDC LGC OPERATE circuit breaker (4CB122) on LEM Cabin Panel XI.

6.3.1.4.2 Depress STBY pushbutton on DSKY for three seconds and verify STBY light on DSKY is OFF.

6.3.1.4.3 On CRT, page 15 line 19, +28V LGC Operate Bus (GG1520) shall indicate between 26.8. Ignore computer alarm indications. Using DSKY, enter VERB 36, then press RSET. All computer alarms shall clear.

6.3.1.4.4 On CRT, page 15 line 21, the +14VDC LGC SUPPLY (GG 1020) shall indicate between 13.8 and 14.2 VDC. Record this value.

6.2.6 IMU Operate power shall never be applied without the presence of LGC Operate and IMU Standby Power.

6.2.7 The G&N System log book shall include the gimbal positions at time of power shutdown. If omitted, it shall be assumed that the gimbals were not parked prior to shutdown. The logbook shall also state if any movement of the IMU or Spacecraft has taken place after shutdown. The times of application and removal of any buss power to the G&N System shall be recorded.

6.2.8 A warmup period of at least one hour in Operate mode is required prior to performing any test in which gyro or accelerometer parameters are measured, and at least 15 minutes prior to any' test in which precision amplitude and frequency power supply checks are made.

6.3 Test Procedures

6.3.1 Standby Power On Tests

6.3.1.1 The Portable Temperature Controller, Model No. 400-31058 shall be supplying inertial component heater power to the G&N System through connector 56J1 (P230). If alarm or fail indications are present on the PTC, they shall be cleared by depressing the SYSTEM RESET pushbutton on the PTC.

6.3.1.2 Verify that spacecraft power checks, including both polarity as well as magnitude on the spacecraft power connectors, have been accomplished.

6.3.1.6.1.3 The DSKY pushbuttons shall be checked by entering:
VERB 25 NOUN 01 ENTR
01740 ENTR
+00123 ENTR
-00456 ENTR
-00789 DO NOT press ENTR
The DSKY shall display +00123 in Row 1, -00456 in Row 2, and -00789 in Row 3. Press CLR pushbutton twice on DSKY. Observe that Row 1, Row 2, and Row 3 are blank.

6.3.1.6.2 Lamp Test

6.3.1.6.2.1 Initiate the Lamp Test by entering in the DSKY:
VERB 35 ENTR

6.3.1.6.2.2 The following DSKY displays shall illuminate for 5 seconds

a. UP LINK ACTY
b. NO ATT
c. STBY
d. KEY REL
e. TEMP
f. GIMBAL LOCK
g. PROG
h. RESTART
i. TRACKER
j. OPR ERROR Flashing
k. VERB-NOUN Flashing
l. Plus 88888 in Row 1, Row 2, and Row 3

On concurrently for 5 seconds

6.3.1.6.3 Uplink Check

6.3.1.6.3.1 On K-START 148; set LOAD/INHIBIT switch to LOAD, set TAPE/KEY switch to KEY, then enter the following:
ERROR RESET
VERB 25 NOUN 01 ENTR
02400 ENTR
+01234 ENTR
-56789 ENTR
+00000 ENTR

6.3.1.6.3.2 Verify the following is displayed on the DSKY.
VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.4 Downlink Check

6.3.1.6.4.1 On CRT, page 20, verify the following is displayed:
VERB 23 NOUN 01
R1 + 01234
R2 - 56789
R3 + 00000

6.3.1.6.5 LGC Self-Check

6.3.1.6.5.1 On K-148 enter the following sequence to initiate the LGC Self-Check:

```
VERB 21 NOUN 01 ENTR
1365            ENTR
00000           ENTR (ER COUNT)
NOUN 15         ENTR
ENTR
00000           ENTR (S COUNT)
00000           ENTR (S COUNT +1)
00000           ENTR (S COUNT +2)
VERB 21 NOUN 27 ENTR
77777           ENTR
VERB 15 NOUN 01 ENTR
1366            ENTR
```

6.3.1.6.5.2 On the CRT, page 20, verify that R1 does not display 01102 or 41102. If a malfunction occurs, the following is displayed:

R1 01102 or 41102
R2 XXXXX c(S FAIL) program address +1 of point of failure
R3 XXXXX number of fails

6.3.1.6.5.3 When R3 = 00002, stop the LGC Self Check by entering in K-148 the following:

```
VERB 21 NOUN 27 ENTR
00000 ENTR
```

6.3.1.6.6 LGC Standby Check

6.3.1.6.6.1 On K-148 enter the following sequence:

```
VERB 21 NOUN 10 ENTR
00013    ENTR
02000    ENTR
```

6.3.1.6.6.2 On DSKY depress STBY pushbutton for approximately 3 seconds.

6.3.1.6.6.3 Verify STBY status indicator lamp is ON.

6.3.1.6.6.4 On the CRT, page 15, line 12, verify the 3.2KC 28V Supply (GT 1331) is between 28.04 and 29.16V RMS.

6.3.1.6.6.5 On DSKY depress STBY pushbutton for approximately 3 seconds to return to LGC OPERATE mode.

6.3.1.6.6.6 Verify STBY status indicator lamp is OFF.

6.3.2 Alarms and Interrupts Test

6.3.2.1 Parity Fail Test

6.3.2.1.1 On K-148 enter the following sequence
VERB 21 NOUN 02 ENTR
01600 ENTR
33777 ENTR

6.3.2.1.2 On CRT, page 20, verify R1 = 33777 and R3 = 01600

6.3.2.1.3 On K-148 enter the following sequence
VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.1.4 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.1.5 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.2 Rupt Lock-Interrupt Too Long

6.3.2.2.1 On K-148 enter the following sequence
VERB 21 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
00001 ENTR
01600 ENTR
00003 ENTR
VERB 31 ENTR

6.3.2.2.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.2.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.3 TC Trap Test

6.3.2.3.1 On K-148 enter the following sequence
VERB 21 NOUN 01 ENTR
01500 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
04000 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.3.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.3.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.4 Nightwatchman Test

6.3.2.4.1 On K-148 enter the following sequence
VERB 24 NOUN 01 ENTR
01600 ENTR
30001 ENTR
01600 ENTR
VERB 25 NOUN 26 ENTR
03400 ENTR
01600 ENTR
00003 ENTR
VERB 30 ENTR

6.3.2.4.2 Verify RESTART, and PGNCS CAUTION lamps are ON.

6.3.2.4.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.3 IMU OPERATE POWER ON TESTS

CAUTION

Prior to application of IMU OPERATE power in step 6.3.3.1.4, LGC OPERATE and IMU STANDBY power must have been applied to the G&N System continuously for a minimum of two hours. The only exception is when the requirements of step 6.2.4.8 are met and this does not apply for the initial application of IMU OPERATE power.

6.3.3.1 Verification of Power Turn-On

6.3.3.1.1 Set up analog recorder 4A1A3 to monitor the following signals:

	CHANNEL	SWITCH POS.	SIGNAL NO.	SIGNAL NAME
a.	1	3	GG2136	MG Servo Error Total
b.	2	1	GG2106	IG Servo Error Total
c.	3	2	GG2166	OG Servo Error Total
d.	4	1	GG2112	IG 1X Resolver Sine
e.	5	2	GG2172	OG 1X Resolver Sine
f.	6	3	GG2142	MG 1X Resolver Sine
g.	7	1	GG1201	IMU 28V 1φ 800 cps
h.	8		SPARE	

6.3.3.1.2 Start analog recorder 4A1A3 to a chart speed of 5 mm/sec. Start event recorder 4A3A5 to a chart speed of .10 mm/sec. (10/100 mm/sec.)

6.3.3.1.3 On CRT, page 15, line 1, monitor +120 VDC PIPA SUPPLY (GG1040) and on page 16, line 20, monitor platform angles.

6.3.3.1.4 Press in +28 VDC IMU OPERATE circuit breaker (4CB124) on LEM Cabin Panel XI. Record time.

6.3.3.1.5 Verify on analog recorder 4A1A3 that the oscillations of the resolver sine signals (GG2112, GG2172, and GG2142) are not sustained and that the signals null out within 15 seconds. If they don't, remove IMU OPERATE power as soon as possible.

6.3.3.1.6 On the CRT, page 15, line 1, verify absence of +120 VDC PIPA SUPPLY voltage for 90 ±10 seconds after step 6.3.3.1.4 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.3.3.1.4.

6.3.3.1.7 On event recorder verify the following:
Channel 15 LGC WARNING is OFF (GG9001) (4A3A5 CH17)
Channel 16 ISS WARNING is OFF (GG9002) (4A3A5 CH18)
Channel 17 PGNCS CAUTION is OFF (GG9003) (4A3A5 CH19)

6.3.3.1.8 On CRT, page 16, line 20, verify all platform angles indicate between 358 and 002.

6.3.3.1.10 On K-148 enter the following sequence:
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.4 Temperature Control Verification.

6.3.4.1 When 15 minutes have elapsed from the time of IMU OPERATE power turn-on record PIP TEMP (GG2300); CRT Page 16, line 9.

6.3.4.2 When 30 minutes have elapsed from the time of IMU OPERATE power turn-on record IRIG TEMP (GG2301); CRT Page 16, line 8.

6.3.4.3 When 2 hours have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP; CRT Page 16, line 9 and IRIG TEMP; CRT Page 16, line 8. The PIPA Temp shall be 130.5 (±1.5)°F. The IRIG TEMP shall be 135 (±2.5°)F.

6.3.4.4 The PIPA TEMP recorded in step 6.3.4.3 shall be within 0.5°F of temperature recorded in steps 6.3.1.5.5 and 6.3.4.1.

6.3.4.5 The IRIG TEMP record in step 6.3.4.3 shall be within 0.5°F of the temperature recorded in step 6.3.4.2.

6.3.5 PGNCS Power Supply Tests

6.3.5.1 From the CRT, confirm power supply voltages (or temperatures) are as specified and record values observed.

6.3.5.2 The PIPA Calibration Module Temperature (GG6020) shall be between +45 and +90 DEG F.

6.3.5.3 The PSA Temperature (GG6021) shall be between +60 and +110 DEG F.

6.3.5.4 The LGC Temperature (GG4300) shall be between +45 and +130 DEG. F.

6.3.5.5 The +28 VDC IMU OPERATE BUSS (GG1500) shall be between 24.5 and 33.5 VDC.

6.3.5.6 The +28 VDC IMU STANDBY BUSS (GG1510) shall be between 24.5 and 33.5 VDC.

6.3.5.7 The +28 VDC LGC OPERATE BUSS (GG1520) shall be between 24.5 and 33.5 VDC.

6.3.5.8 The +120 VDC PIPA Supply (GG1040) shall be between 114 and 126 VDC.

6.3.5.9 The -28VDC Supply (GG1100) shall be between -21.5 and -33.5 VDC.

6.3.5.10 The +4VDC CDU Supply (GG1070) shall be between 3.8 and 4.2 VDC.

6.3.5.11 The IMU 28V 800 CPS 1 pct Supply (GG1201) shall be between 27.4 and 28.6 VRMS.

6.3.5.12 The IMU 28V 800 CPS 5 pct 90 PH Supply(GG1202) shall be between 26.6 and 29.4 VRMS.

6.3.5.13 The IMU 28V 800 CPS 5 pct 0 PH Supply (GG1203) shall be between 25.9 and 30.1 VRMS.

6.3.5.14 The 3.2 KC 28V Supply (GG1331) shall be between 28.04 and 29.16 VRMS.

6.3.5.15 The 2.5 VDC T/M Bias (GG1110) shall be between 2.37 and 2.63 VDC.

6.3.5.16 The +14 VDC LGC Supply (GG1020) shall be between 13.8 and 14.2 VDC.

6.3.5.17 The +4VDC LGC Supply (GG1030) shall be between 3.85 and 4.15 VDC.

6.3.6 IMU OPERATIONAL TEST

6.3.6.1 In K-148 enter the following sequence:
VERB 57 ENTR
00004 ENTR

6.3.6.2 Wait 200 seconds, then verify on the CPT, page 16 lines 1,2, and 3 that the X, Y and Z PIPA SG Output signals all indicate ±2.5 Volts but not 0.

6.3.6.3 Approximately 12 minutes after performing step 6.3.6.1, VERB 06 NOUN 66 shall flash.

6.3.6.4 From the CRT, page 20 lines 3-4, read and record R1 and R2 (local gravity whole and fractional respectively). The value recorded shall be between 975.0 and 985.9 cm/sec^2.

6.3.6.5 On K-148 enter the following sequence
VERB 33 ENTR
VERB 06 NOUN 66 shall flash.

6.3.6.6 From the CRT, page 20 lines 4, read and record the horizontal fractional component of earth rate acting on the X, Y, and Z IRIG's as displayed in R2. The value recorded shall be between .65750 and .85750.

6.3.6.7 Terminate the test by entering in K-148 the following:
VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.7 PGNCS Operational Test

6.3.7.1 Start the PGNCS Operational test by inserting the following sequence into K-148
VERB 57 ENTR
00010 ENTR
Program 07 shall be displayed
VERB 33 NOUN 01 is displayed flashing

6.3.7.2 Command Accuracy 0°

6.3.7.2.1 On K-148, press ENTR pushbutton
VERB 33 NOUN 02 is displayed flashing
Press ENTR pushbutton.
VERB 33 NOUN 03 is displayed flashing

6.3.7.2.2 Read and record the CDU indications of CRT page 16, line 20. The indications shall be 000±001 degree.

6.3.7.2.3 Read and record the DSKY Row indications of CRT page 20, lines 3, 4 and 5. The indications shall be +00000 ± 00003.

6.3.7.3 Command Accuracy 45°

6.3.7.3.1 On K-148, press ENTR, pushbutton VERB 33 NOUN 04 is display flashing after approximately 20 seconds.

6.3.7.3.2 Read and record the CDU indications of CRT page 16, line 20. The indications shall be 045 ± 001 degrees.

6.3.7.3.3 Read and record the DSKY Row indications of CRT page 20, lines 3, 4 and 5. The indications shall be +04500 ± 00003.

6.3.7.4 CDU Repeating Accuracy 45°

6.3.7.4.1 On K-148 press ENTR pushbutton. In about 90 seconds VERB 05 NOUN 30 is displayed flahsing.

6.3.7.4.2 Read and record the DSKY Row indications of CRT, page 20, lines 3, 4 and 5. The indications shall be between 77774 and 00003.

6.3.7.5 Command Accuracy 90°

6.3.7.5.1 On K-148 insert VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 06 is displayed flashing. The GIMBAL LOCK damp on DSKY shall be lighted.

6.3.7.5.2 Read and record the CDU indications of CRT page 16, line 20. The indications shall be 090 ± 001 degrees.

6.3.7.5.3 Read and record the DSKY Row indications of CRT page 20, lines 3, 4 and 5. The indication shall be +09000 ± 00003.

6.3.7.6 Command Accuracy 135°

6.3.7.6.1 On K-148 press ENTR pushbutton. In approximately 20 seconds VERB 33 NOUN 07 is displayed flashing.

6.3.7.6.2 Read and record the CDU indication of CRT page 16, line 20. The indications shall be 135 ± 001 degrees.

6.3.7.6.3 Read and record the DSKY Row indications of CRT page 20 lines 3, 4 and 5. The indications shall be +13500 ± 00003.

6.3.7.7 On K-148 press ENTR pushbutton. In approximately 20 seconds VERB 33 NOUN 10 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.8 CDU Repeating Accuracy 135°

6.3.7.8.1 On K-148 press ENTR pushbutton. In about 90 seconds, VERB 05 NOUN 30 is displayed flahsing.

6.3.7.8.2 Read and record the DSKY Row indication of CRT page 20, lines 3, 4 and 5. The indications shall be between 77774 and 00003.

6.3.7.9 + Gimbal Lock Test

6.3.7.9.1 On K-148, insert VERB 33, ENTR. In approximately 20 seconds VERB 33 NOUN 12 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.10 Command Accuracy 225°.

6.3.7.10.1 On K-148 press ENTR pushbutton. In approximately 20 seconds, VERB 33, NOUN 13 is displayed flashing.

6.3.7.10.2 Read and record the CDU indications of CRT page 16 line 20. The indication shall be 225 ± 001 degrees.

6.3.7.10.3 Read and record the DSKY Row indications of CRT page 20 lines 3, 4 and 5. The indications shall be +225 ± 00003.

6.3.7.11 On K-148 press ENTR pushbutton. In approximately 20 seconds VERB 33 NOUN 14 is displayed. The GIMBAL LOCK lamp shall not be lighted.

6.3.7.12 CDU Command Rate Test

6.3.7.12.1 On K-148 press ENTR pushbutton. In approximately 30 seconds VERB 06 NOUN 66 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.

6.3.7.12.2 Read and record the DSKY Row indication of CRT page 20 line 3. The indication shall be between 00012 and 00016.

6.3.7.12.3 Repeat 6.3.7.12.1 and 6.3.7.12.2. The GIMBAL LOCK lamp on DSKY shall not be lighted.

6.3.7.12.4 Repeat 6.3.7.12.1 and 6.3.7.12.2.

6.3.7.13 Command Accuracy 315°.

6.3.7.13.1 On K-148 insert VERB 33 ENTR. In approximately 20 seconds VERB 33 NOUN 20 will be displayed flashing.

6.3.7.13.2 Read and record the CDU indications of CRT page 16 line 20. The indicator shall be 315 ± 001 degrees.

6.3.7.13.3 Read and record the DSKY row indications of CRT page 20 lines 3, 4 and 5. The indications shall be +315 ± 001.

6.3.7.14 CDU Repeating Accuracy 315°.

6.3.7.14.1 On K-148 press ENTR pushbutton. In approximately 90 seconds VERB 05 NOUN 30 is displayed flashing.

6.3.7.14.2 Read and record the DSKY Row indications of CRT page 20 lines 3, 4 and 5. The indications shall be between 77774 and 00003.

6.3.7.15 -Gimbal Lock Test

6.3.7.15.1 On K-148 insert VERB 33 ENTR. In approximately 20 seconds VERB 33, NOUN 22 is displayed flashing. The GIMBAL LOCK on DSKY lamp shall be lighted.

6.3.7.16 CDU Repeating Accuracy 225°.

6.3.7.16.1 On K-148, press ENTR pushbutton. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.

6.3.7.16.2 Read and record the DSKY row indications of CRT page 20 lines 3, 4 and 5. The indication shall be between 77766 and 77775.

6.3.7.17 On K-148 insert VERB 33 ENTR. The GIMBAL LOCK lamp shall not be lighted. VERB 21, NOUN 22 is displayed flashing.

6.3.7.18 IMU CDU Fine Fail Test

6.3.7.18.1 On K-148 insert the following sequence
+00100 ENTR
+00100 ENTR
+00100 ENTR
On Event Module 4A3A5 verify that lamp 17 lights.

6.3.7.18.2 After approximately 90 seconds, insert ENTR, 00030, ENTR into K-148. Verify that CRT page 20, line 3 indicates 33XXX.

6.3.7.19 IMU CDU Coarse Fail Test

6.3.7.19.1 On K-148 insert the following sequence
VERB 33 ENTR
+03750 ENTR
+03750 ENTR
+03750 ENTR
Verify that lamp 17 of Event Module 453A5 lights.

6.3.7.19.2 After approximately 90 seconds, insert ENTR, 00030, ENTR into K-148. Verify that CRT page 20, line 3 indicates 33XXX.

6.3.7.20 FDAI Linearity Test

6.3.7.20.1 On K-148 enter VERB 33 ENTR
VERB 33 NOUN 26 shall be displayed.

6.3.7.20.2 On CRT page 16 verify the following
Line 22 PITCH ATT ERROR is between +15.3 and +18.6 DEG (GG2219)
Line 23 YAW ATT ERROR is between +15.3 and +18.7 DEG (GG2249)
Line 24 ROLL ATT ERROR is between +15.3 and +18.7 DEG (GG2279)

6.3.7.20.3 On K-148 press ENTR pushbutton
VERB 33 NOUN 27 shall be displayed

6.3.7.20.4 On CRT page 16 verify the following
Line 22 PITCH ATT ERROR is between +14.4 and +17.6 DEG (GG2219)
Line 23 YAW ATT ERROR is between +14.4 and +17.6 DEG (GG2249)
Line 24 ROLL ATT ERROR is between +14.4 and +17.6 DEG (GG2279)

6.3.7.20.5 On K-148 press ENTR pushbutton
VERB 33 NOUN 30 shall be displayed

6.3.7.20.6 On CRT page 16 verify the following
Line 22 PITCH ATT ERROR is between +05.4 and +06.6 DEG (GG2219)
Line 23 YAW ATT ERROR is between +05.4 and +06.6 DEG (GG 2249)
Line 24 ROLL ATT ERROR is between +05.4 and +06.6 DEG (GG2270)

6.3.7.20.6.1 On CRT page 12 verify the following
Line 7 IG 1X Resolver Sin (11°) is between +05.4 and +06.6 DEG (GG2121)
Line 4 MG 1X Resolver Sin (11°) is between +05.4 and +06.6 DEG (GG2151)
Line 6 OG 1X Resolver Sin (11°) is between +05.4 and +06.6 DEG (GG2181)

6.3.7.20.7 On K-148 press ENTR pushbutton
VERB 33 NOUN 31 shall be displayed

6.3.7.20.8 On CRT page 16 verify the following
Line 22 PITCH ATT ERROR is between +00.2 and -00.2 DEG (GG2219)
Line 23 YAW ATT ERROR is between +00.2 and -00.2 DEG (GG2249)
Line 24 ROLL ATT ERROR is between +00.2 and -00.2 DEG (GG2279)

6.2.7.20.9 On K-148 press ENTR pushbutton
VERB 33 NOUN 32 shall be displayed

6.3.7.20.10 On CRT page 16 verify the following
Line 22 PITCH ATT ERROR is between -05.4 and -06.6 DEG (GG2219)
Line 23 YAW ATT ERROR is between -05.4 and -06.6 DEG (GG2249)
Line 24 ROLL ATT ERROR is between -05.4 and -06.6 DEG (GG2279)

6.3.7.20.11 On K-148 press ENTR pushbutton
VERB 33 NOUN 33 shall be displayed.

6.3.7.20.12 On CRT page 16 verify the following:
Line 23 PITCH ATT ERROR is between -14.4 and -17.6 DEG (GG2219)
Line 23 YAW ATT ERROR is between -14.4 and -17.6 DEG (GG2249)
Line 24 ROLL ATT ERROR is between -14.4 and -17.6 DEG (GG2279)

6.3.7.20.13 On K-148 press ENTR pushbutton
VERB 33 NOUN 34 shall be displayed

6.3.7.20.14 On CRT page 16 verify the following:
Line 22 PITCH ATT ERROR is between -15.3 and -18.7 DEG (GG2219)
Line 23 YAW ATT ERROR is between -15.3 and -18.7 Deg (GG2219)
Line 24 ROLL ATT ERROR is between -15.3 and -18.7 Deg (GG2279)

6.3.7.21 On K-148 enter VERB 36 ENTR.
The proper operation of the IMU CAGE function (consisting of steps 6.3.7.33 thru 6.3.7.41) need be performed only once during the initial PGNCS Operational Test and omitted from subsequent testing of test 6.3.7.

6.3.7.21.1 On K-148 enter the following sequence:
+00500 ENTR
+00500 ENTR
+00500 ENTR

6.3.7.21.2 On the CRT, page 16, line 20, verify all platform angles indicate between 003 and 007 DEG.

6.3.7.21.3 On analog recorder 4A1A3, monitor the following signals:

	CHANNEL	SWITCH POS.	SIGNAL NO.	SIGNAL NAME
a.	1	3	GG2136	MG Servo Error Total
b.	2	1	GG2106	IG Servo Error Total
c.	3	2	GG2166	OG Servo Error Total
d.	4	1	GG2112	IG 1X Resolver Sine
e.	5	2	GG2172	OG 1X Resolver Sine
f.	6	3	GG2142	MG 1X Resolver Sine
g	7	1	GG1201	IMU 28V 1ϕ 800 cps
h.	8		SPARE	

6.3.7.21.4 Start analog recorder 4A1A3 to a chart speed of 5 mm/sec.

6.3.7.21.5 On LEM Cabin Panel 4, hold IMU CAGE momentary toggle switch in the ON position. (Do not release).

6.3.7.21.6 On analog recorder 4A1A3, verify the 1X Resolver Sine signals in channels 4-5-6 (GG 2112, GG 2172, GG 2142) null out to less than 0.5 VRMS. Release IMU CAGE switch to the OFF position. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Any sustained oscillations shall be cause for immediate removal of IMU Operate power.

6.3.7.21.7 On the CRT, page 16 line 20, verify all platform angles indicate 358 and 002.

6.3.7.22 Stop analog recorder 4A1A3.

6.3.7.23 On K-148 enter the following sequence:

VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.8 IRIG Scale Factor Determination

6.3.8.I Insure that the IMU Operate power and LGC Operate power have been applied for a minimum of one hour and that the IMU is not in a gimbal lock condition.

6.3.8.2 On the meter module 4A2A3, monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.8.3 On K-148 enter the following sequence:

VERB 57 ENTR
00005 ENTR

6.3.8.4 PROG 07 shall be displayed.

6.3.8.5 VERB 06 NOUN 61 shall flash.

6.3.8.6 On the DSKY, Row 1 (Navigation Base azimuth) and Row 2 (Site latitude shall be displayed).

6.3.8.7 If values for Row 1 and Row 2 are correct, proceed to the next step.
If values for Row 1 and Row 2 are incorrect, enter the following sequence into K-148:
VERB 24 ENTR
±xxxxx ENTR (Correct navigation base azimuth)
±xxxxx ENTR (Correct site latitude)
Verify values in Row 1 and Row 2 are correct.

6.3.8.8 On K-148 enter the following sequence:
VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 thru 6.3.8.8.

6.3.8.9 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from DSKY Row 1 (-X IRIG Scale Factor error in part per million. Position +00001)

6.3.8.10 On K-148 enter the following sequence:
VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 thru 6.3.8.7 and 6.3.8.10.

6.3.8.11 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from DSKY Row 1 (-Y IRIG Scale Factor error in parts per million Position +00002).

6.3.8.12 On K-148 enter the following sequence:
VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
+00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 thru 6.3.8.7 and 6.3.8.12.

6.3.8.13 In approximately 200 seconds VERB 06 NOUN 66 shall flash.
Read and record from DSKY Row 1 (+Z IRIG Scale Factor error in parts per million Position +00003).

6.3.8.14 On K-148 enter the following sequence:
VERB 33 ENTR (VERB 21 NOUN 33 shall flash)
-00001 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 thru 6.3.8.7 and 6.3.8.14.

6.3.8.15 In approximately 200 seconds, VERB 06 NOUN 66 shall flash.
Read and record from DSKY Row (+X IRIG Scale Factor error in parts per million. Position - 00001)

6.3.8.16 On K-148 enter the following sequence:
VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00002 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 thru 6.3.8.7 and 6.3.8.16.

6.3.8.17 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from DSKY Row 1 (+Y IRIG Scale Factor error in parts per million Position -00002).

6.3.8.18 On K-148 enter the following sequence:
VERB 33 ENTR (VERB 21 NOUN 30 shall flash)
-00003 ENTR
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps, 6.3.8.3 thru 6.3.8.7 and 6.3.8.18.

6.3.8.19 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from DSKY Row 1(-Z IRIG Scale Factor error in parts per million Position -00003).

6.3.8.20 Repeat steps 6.3.8.8 thru 6.3.8.19 twice to obtain second and third set of data.

6.3.8.21 Terminate this test by entering in K-148 the following:
VERB 34 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.8.22 The average of the three readings of Scale Factor Error for each of the 6 positions shall be -556 ±1750 PPM.

6.3.9 IMU Performance Test. A reference data sheet is provided at the end of this section to aid in data reduction. Table 1 of the data sheet should be completed before the start of this test.

6.3.9.1 Insure that IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.9.2 On CRT display, page 16, monitor and record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).

6.3.9.3 Adjust oscilloscope 4A4A1 to display butterfly of X PIPA.

6.3.9.4 On K-148 enter the following sequence:

VERB 57 ENTR
00001 ENTR
VERB 06 NOUN 61 shall flash

6.3.9.5 On the CRT, page 20, lines 2 and 3, R1 (Navigation Base Azimuth) and R2 (Site Latitude) shall be displayed.

6.3.9.6 If values for R1 and R2 are correct, proceed to next step. If values for R1 and R2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR
± xxx.xx ENTR (Correct navigation base azimuth ± 0.50 deg)

+ xx.xxx ENTR (Correct site latitude)
Verify values in R1 and R2 are correct

6.3.9.7 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.8 On CRT, page 20, lines 2, 3 and 4, verify R1 = +00600 (Time), R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position). If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00600 ENTR (Test Time in minutes)
+00000 ENTR (Test Index Number)
+00001 ENTR (Test Position entry)

6.3.9.9 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.10 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, page 20, line 3, record R2 (+NBDY Position +00001).

6.3.9.11 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.12 After 100 seconds, take a photograph of Y and Z PIPA butterfly patterns on oscilloscope 4A4A1.

6.3.9.13 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, page 20, lines 2 and 3, record R1 and R2 (+X PIPA Position +00001). Row 1 is wholepart, Row 2 is fractional part. Units are cm/sec^2.

6.3.9.14 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.15 On CRT, page 20, lines 2, 3 and 4 - verify R1 = +00600, R2 = +00000, and R3 = +00002.

6.3.9.16 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.17 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, page 20, line 3, record R2 (+NBDZ Position +00002).

6.3.9.18 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.19 Approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, page 20, lines 2-3, record R1 and R2 (-X PIPA Position +00002). NOTE: The following step must be done within one minute after VERB 06 NOUN 66 flash in preceding step.

6.3.9.20 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.21 In approximately 67 minutes, VERB 06 NOUN 66 shall flash. From the CRT, page 20, line 3, record R2 (-NBDX + ADIAX Pos +00002).

6.3.9.22 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.23 On CRT, page 20, lines 2,3, and 4, verify R1 = +00600, R2 = +00000, and R3 = +00003.

6.3.9.24 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.25 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, page 20, line 3, record R2 (-NBDX Position +00003).

6.3.9.26 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.27 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, page 20, lines 2 and 3, record R1 and R2 (+Z PIPA Position +00003).

6.3.9.28 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.29 On the CRT, page 20, lines 2, 3 and 4, verify R1 = +00600, R2 = 00000, and R3 - +00004.

6.3.9.30 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.31 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, page 20, line 3 record R2 (+NBDY + ADSRAY Position +00004).

6.3.9.32 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.33 After 100 seconds, take a photograph of the X-PIPA butterfly pattern on oscilloscope 4A4A1.

6.3.9.34 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, page 20, lines 2 and 3, record R1 and R2 (-X PIPA Position +00004).

NOTE: The following step must be performed within one minute after VERB 06 NOUN 66 flash in preceding step.

6.3.9.35 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.36 In approximately 67 minutes VERB 06 NOUN 66 shall flash. From the CRT, page 20, line 3, record R2 (+NBDZ + ADIAZ Position +00004).

6.3.9.37 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash.

6.3.9.37 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.38 From the CRT, page 20, lines 2, 3, and 4, verify R1 = +00600, R2 = +00000 and R3 = +00005.

6.3.9.39 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.40 The PROG alarm and GIMBAL LOCK lamps shall light.

6.3.9.41 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, page 20, lines 2 and 3, record R1 and R2 (+Y PIPA Position +00005).

6.3.9.42 On K-148 enter the following sequence:
Press Error Reset
VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.43 On the CRT, page 20, lines 2, 3, and 4, verify R1 = +00600, R2 = +00000 and R3 = +00006.

6.3.9.44 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.45 The PROG alarm and GIMBAL LOCK lamps shall light

6.3.9.46 In approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, page 20, lines 2 and 3, record R1 and R2. (-Y PIPA Position +00006).

6.3.9.47 On K-148 enter the following sequence:
Press Error Reset
VERB 34 ENTR
VERB 06 NOUN 66 shall flash

6.3.9.48 On the CRT, page 20, lines 2, 3, and 4, verify R1 = +00600, R2 = +00000 and R3 = +00007.

6.3.9.49 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.50 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, page 20, line 3, record R2 (+.707 ADSRAX-NBDX Position +00007).

6.3.9.51 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash.

6.3.9.52 On the CRT, page 20, lines 2, 3, and 4, verify R1 = +00600, R2 = +00000, and R3 = +00008.

6.3.9.53 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.54 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, page 20, line 3, record R2 [-.707 (NBDZ+NBDY) +0.5 (ADIAZ - ADIAY) +0.5 (ADSRAY + ADSRAZ)] (Position + 00008).

6.3.9.55 On K-148 enter the following:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash.

6.3.9.56 On the CRT, page 20, lines 2, 3, and 4, verify R1 = +00600, R2 = +00000, and R3 = +00009.

6.3.9.57 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.58 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, page 20, line 3, record R2 (-NBDZ + .707 ADSRAZ Position +00009).

6.3.9.59 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 66 shall flash.

6.3.9.60 On the CRT, page 20, lines 2, 3, and 4, verify R1 = +00600, R2 = +00000, and R3 = +00010.

6.3.9.61 On K-148 enter the following sequence:

VERB 33 ENTR

6.3.9.62 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, page 20, line 3 record R2 [.707 (NBDY-NBDX) +.5 (ADIAY - ADIAX) +.5 ADSRAX] (Position +00010).

6.3.9.63 Terminate this test by entering in K-148 the following:

VERB 36 ENTR

6.3.9.64 On CRT, page 16, record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).

6.3.9.65 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

ITEM NO.	PARAMETER	UNITS	MIN VALUE	RECORDED VALUE	MAX VALUE	REJ	ACC	
6.3.9. 11	+N BDY Position +00001	meru		( ) ---.--				a.
6.3.9. 13	+X PIPA Test Position +00001	cm/sec^2		( ) 00---. ( ) -----				b.
6.3.9. 17	+N BDZ Position +00002	meru		( ) ---.--				c.
6.3.9. 19	-X PIPA Test Position +00002	cm/sec^2		( ) 00 ---. ( ) -----				d.
6.3.9. 21	-N BDX + ADIAX Position +00002	meru		( ) ---,--				e.
6.3.9. 25	-N BDX Position +00003	meru		( ) ---.--				f.
6.3.9. 27	+ Z PIPA Test Position +00003	cm/sec^2		( ) 00---. ( ) -----				g.
6.3.9. 31	+N BDY + ADSRAY Position +00004	meru		( ) ---.--				h.
6.3.9. 33	-Z PIPA Test Position +00004	cm/sec^2		( ) 00---. ( ) -----				i.
6.3.9. 36	+N BDZ + ADIAZ Position +00004	meru		( ) ---.--				j.
6.3.9. 41	+Y PIPA Test Position +00005	cm/sec^2		( ) 00---. ( ) -----				k.
6.3.9. 46	-Y PIPA Test Position +00006	cm/sec^2		( ) 00---. ( ) -----				l.

DATE ____________

6.3.11 LGC Clock Frequency Test

6.3.11.1 Insure that LGC Operate power has been applied for a minimum of 10 minutes before performing this test.

6.3.11.2 Verify that the counter is connected to the 3.2 kc signal on the hardline.

6.3.11.3 Insure that the counter has been warming up for a minimum of 30 minutes.

6.3.11.4 On the counter,
Set the FUNCTION switch to: MAN START
Set the TIME BASE switch to: 1 μs TIME UNIT/COUNT
Set the SENSITIVITY control to: CHECK

6.3.11.5 Verify proper counter operation.

6.3.11.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.

6.3.11.7 Plug in the Preset unit and set:
MODE switch to PRESET
N switches to 96000

6.3.11.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.

6.3.11.9 Start counting by depressing RESET switch on counter.

6.3.11.10 After approximately 30 seconds, read and record counter display.

6.3.11.11 Repeat steps 6.3.11.9 and 6.3.11.10 9 times.

6.3.11.12 The average of the 10 previous readings shall be 30.000000 ± 0.000060 seconds.

6.3.11.13 Insure that the System is not in IMU Operate.

6.3.11.14 Perform the following DSKY operations
VERB 21 NOUN 10 ENTR
00013 ENTR
02000 ENTR
Press and hold the STBY pushbutton on the DSKY for 3 sec.
Verify the Standby pushbutton is lit.

6.3.11.15. Repeat steps 6.3.11.9 through 6.3.11.12.

6.3.11.16 Press and hold the STBY pushbutton on the DSKY for 3 sec.
Verify the Standby pushbutton is not lit.

ITEM NO.	PARAMETER	UNITS	MIN VALUE	RECORDED VALUE	MAX VALUE	REJ	ACC	
6.3.9 58	-NBDX+.707ADSRAX Position +00007	meru						m.
6.3.9 54	-.707(NBDZ+NBDY) +0.5(ADIAZ-ADIAY) +0.5(ADSRAY+ADSRAZ) Position +00008	meru						n.
6.3.9.58	-NBDZ+.707ADSRAZ Position +00009	meru						o.
6.3.9.62	.707(NBDY-NBDX) +.5(ADIAY-ADIAX) +.5 ADSRAX Position +00010	meru						p.

DATE ____________

CALCULATION	PARAMETER	UNITS	
line c - line f = ( ) ---.-- (-NBDX+ADIAX) - (-NBDX)	ADIAX	meru	q
line h - line a = ( ) (+NBDY+ADSRAY) - (+NBDY) ---.--	ADSRAY	meru	r
line j - line c = ( ) (+NBDZ+ADIAZ) - (NBDZ) ---.--	ADIAZ	meru	s
(line m - line f) X1.414 = ( ) ---.-- [(-NBDX + .707 ADSRAX) -(-NBDX)] X 1.414	ADSRAX	meru	t
(line o + line c) X1.414 = ( ) (-NBDZ+.707 ADSRAZ + NBOZ) X1.414 ---.--	ADSRAZ	meru	u
(line p -.707 line a -.707 line f +.5 line q -.5 line t) X2 = ---.-- [.707 (NBDY-NBDX) +.5 (ADIAY -ADIAX) +.5 ADSRAX -.707 (-NBDX) +.5 ADIAX -.5 ADSRAX] X2	ADIAY	meru	v
line b - line d = ( )	PIPA X2G	cm/sec^2	w
line k - line l = ( )	PIPA X2G	cm/sec^2	x
line g - line i = ( )	PIPA Z2G	cm/sec^2	y
1960.52 ÷ line w X 1 cm/sec/pulse Transfer results to line ay	X PIPA S.F.	cm/sec/pulse	z
1960.52 ÷ line x X 1cm/sec/pulse Transfer results to line az	Y PIPA S.F.	cm/sec/pulse	aa
1960.52 ÷ line y X /cm/sec/pulse Transfer results to line ba	Z PIPA S.F.	cm/sec/pulse	ab
1/2 (line b + line d) = ( ) --.--- Transfer results to line bb	X PIPA Bias	cm/sec^2	ac
1/2 (line k + line l) = ( ) --.--- Transfer results tolline bc	Y PIPA Bias	cm/sec^2	ad
1/2 (line g + line i) = ( ) --.--- Transfer results to line bd	Z PIPA Bias	cm/sec^2	ae
Perform the following calculations for values of NBD, ADSRA and ADIA. The constants are obtained from Table II Transfer results to items ap through ax on data sheet			af
NGDY = line a - NBDY NBDY =		meru	ag
NBDZ = line c - NBDZ NBDZ =		meru	ah
NBDX = (-line f) - NBDX NBDX =		meru	ai
ADIAX = line q - ADIAX ADIA X =		meru	aj
ADSRAY = line r - ADSRAY ADSRAY =		meru	ak
ADIAZ = line s = line s - ADIAZ ADIAZ =		meru	al
ADSRAX = line t - ADSRAX ADSRAX =		meru	am
ADSRAZ = line m - ADSRAZ ADSRAZ =		meru	an
ADIAY = line v - ADIAY ADIAY =		meru	ao

ITEM NO.	PARAMETER	UNITS	MIN VALUE	RECORDED VALUE	MAX VALUE	REJ	ACC	
	ΔBDY	meru	-5.0		+5.0			ap
	ΔBDZ	meru	-5.0		+5.0			ag
	Δ BDX	meru	-5.0		+5.0			ar
	Δ ADSRAY	meru	-10.0		+10.0			as
	Δ ADSRAZ	meru	-10.0		+10.0			at
	Δ ADSRAX	meru	-10.0		+10.0			au
	Δ ADIAX	meru	-15.0		+15.0			av
	Δ ADIAZ	meru	-15.0		+15.0			aw
	Δ ADIAY	meru	-15.0		+15.0			ax
	X PIPA S.F. from line z	cm/sec /pulse	.9996		1.0004			ay
	Y PIPA S.F. from line aa	cm/sec /pulse	.9996		1.0004			az
	Z PIPA S.F. from line ab	cm/sec /pulse	.9996		1.0004			ba
	X PIPA Bias from line ac	cm/sec^2	-0.5		+0.5			bb
	Y PIPA Bias From line ad	cm/sec^2	-0.5		+0.5			bc
	Z PIPA Bias from line ae	cm/sec^2	-0.5		+0.5			bd

DATE ____________

6.3.10 LGC Voltage Margin Test

6.3.10.1 Initial Conditions

6.3.10.1.1 Insure that the G&N System is in Standby Mode as defined in section 6.2.4.11.

6.3.10.1.2 On the CRT, page 15, line 19, verify the +28 VDC LGC OPERATE buss is between 24.5 and 33.5 VDC (GG 1520).

6.3.10.1.3 On the CRT, page 15, line 5, verify the +28 V IMU OPERATE power is OFF.

6.3.10.2 Voltage Margin Determination

6.3.10.2.1 On the PSA Adapter Module (PSAAM) (410-31080), place INHIBIT VOLTAGE FAIL switch to ON.

CAUTION: The +4VDC LGC Supply voltage shall never be operated lower than +2.5VDC or higher than +5.2VDC (GG 1030).

The +14VDC LGC Supply shall never be operated less than +8.5VDC or higher than +17.0VDC (GG 1020).

NOTE: The flashing indication of the LGC Supplies may be disregarded for this test. The charts in Table II may be used to determine approximate values for the "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.

6.3.10.2.2 On 4A1A5 enter in C-156 ±XX.X001114 (Enter a value for XX.X which will adjust the +14V power supply as monitored on the CRT, page 15, line 21 to 12.2 (+0.3, -0) VDC. See Table I) Execute

6.3.10.2.3 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the +4V power supply as monitored on the CRT, page 15, line 23 to 3.5 (+0.15, -0) VDC. See Table I) Execute

6.3.10.2.4 On 4A2A6, enter in R-1550001. Verify and execute

6.3.10.2.5 On 4A2A6 enter in R-1541111. Verify and execute

6.3.10.2.6 On K-148 press ERROR RESET.

6.3.10.2.7 On K-148 initiate LGC Self-Check by entering the following:

VERB 21 NOUN 27 ENTR
77767 ENTR

Wait 200 seconds. Verify RESTART lamp on the DSKY is not lit.

JDC	PARAMETER	VALUE
16236	BDX	
16236	ADSRAX	
16237	ADIAX	
16239	BDY	
16239	ADSRAY	
16240	ADIAY	
16242	BDZ	
16242	ADSRAZ	
16243	ADIAZ	

Table 1

6.3.10.2.8 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lit.

6.3.10.2.9 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations

VERB 21	NOUN 27	ENTR
77767		ENTR

6.3.10.2.10 On 4A1A5 enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the +14V power supply as monitored on the CRT, page 15, line 21 to 16.4 (+0, -0.4) VDC. See Table I Execute

6.3.10.2.11 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.

6.3.10.2.12 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lit. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations

VERB 21	NOUN 27	ENTR
77767		ENTR

6.3.10.2.13 On 4A1A5 enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the 4V power supply as monitored on the CRT, page 15, line 23 to 4.7 (+0, -0.2) VDC. See Table I) Execute

6.3.10.2.14 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.

6.3.10.2.15 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lit. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations

VERB 21	NOUN 27	ENTR
77767		ENTR

6.3.10.2.16 On 4A1A5 enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the 14V power supply as monitored on the CRT, page 15, line 21 to 12.2 (+0.3, -0) VDC. See Table I) Execute

6.3.10.2.17 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.

6.3.10.2.18 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verfiy RESTART lamp on the DSKY is lit.

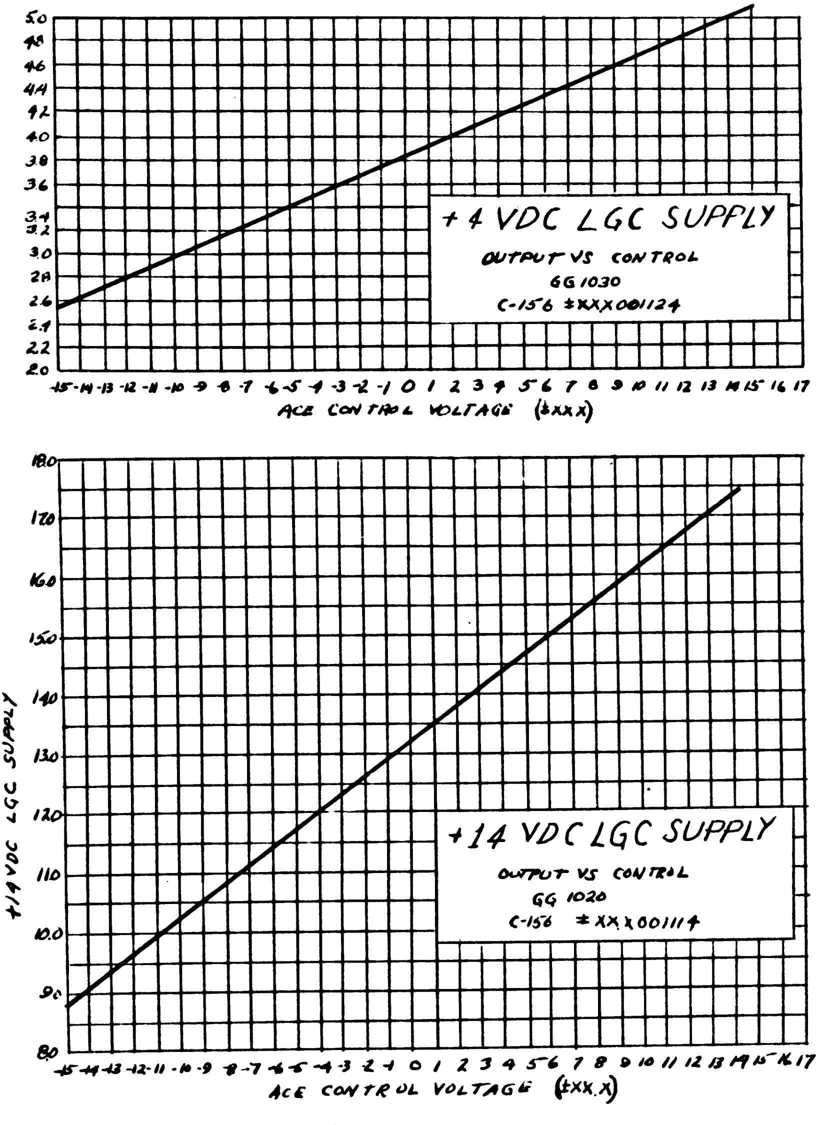
6.3.10.2.19 On R-154 enter 0000. Execute

6.3.10.2.20 On R-155 enter 0000. Execute

6.3.10.2.21 On K-148 terminate the LGC Self-Check by entering the following:

VERB 21	NOUN 27	ENTR
00000		ENTR

6.3.10.2.22 On K-148 press ERROR RESET.



+4 VDC LGC SUPPLY

OUTPUT VS CONTROL

GG 1030

C-156 ±XXX001124

+14 VDC LGC SUPPLY

OUTPUT VS CONTROL

GG 1020

C-156 ±XXX001114

TABLE I

6.3.11.17	On the Computer Control and Reticle dimmer assembly, press and hold MARK X pushbutton.
6.3.11.18	On the DSKY observe VERB 05 NOUN 31 Row 1 = 00112 Prog Alarm lit
6.3.11.19	Enter the following on K-148 VERB 11 NOUN 10 ENTR 00016 ENTR
6.3.11.20	Observe that DSKY Row 1 displays 00004.
6.3.11.21	Release MARK X pushbutton
6.3.11.22	Observe that DSKY Row 4 displays 00000.
6.3.11.23	Press and hold the MARK Y pushbutton or the Computer Control and Reticle Dimmer Assembly.
6.3.11.24	Observe that DSKY Row 1 displays 00010.
6.3.11.25	Release MARK Y pushbutton.
6.3.11.26	Observe that DSKY Row 1 displays 00000.
6.3.11.27	Press and hold the REJECT pushbutton or the Computer Control and Reticle Dimmer Assembly.
6.3.11.28	Observe that DSKY Row 1 displays 00020.
6.3.11.29	Release the REJECT pushbutton.
6.3.11.30	Observe that DSKY Row 1 displays 00000.
6.3.11.31.	On the DSKY perform the following operation VERB 36 ENTR

6.3.12 **Gimbal Friction Test**

6.3.12.1 **Inner Gimbal Friction Test**

6.3.12.1.1 On console 4A2A5, call up page 20 on CRT display.

6.3.12.1.2 On K-148 enter the following sequence:

```
VERB 40  NOUN 20   ENTR   Wait 3 seconds
VERB 41  NOUN 20   ENTR
+00000  ENTR
+00000  ENTR
+00000  ENTR
```

6.3.12.1.3 On the CRT, page 20, lines 19, 20 and 21 verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.1.4 Set up Analog Recorder 4A1A3 to monitor the following signals:

	MEAS. NO.	SIGNAL NAME	RECORDER CHANNEL	ANALOG SELECT SWITCH POSITION
a.	GG2110	IG Torque Motor Current	1	1
b.	GG2106	IG Servo Error Total	2	1
c.	GG2107	IG Servo Error In Phase	3	1
d.	GG2112	IG 1x Resolver Sine	4	1
e.	GG2113	IG 1x Resolver Cosine	5	1
f.	GG2220	IG CDU Fine Error	6	1
g.	GG1201	IMU 28 V 1% 800 CPS	7	1
h.		SPARE	8	1

6.3.12.1.5 Set up Analog Recorder 4A3A2 to monitor the following signals:

	MEAS. NO.	SIGNAL NAME	RECORDER CHANNEL	ANALOG SELECT SWITCH POSITION
a.		SPARE	1	3
b.	GG2300	PIPA TEMP	2	3
c.	GG2301	IRIG TEMP	3	3
d.	GG1520	+28 VDC LGC OPR BUSS	4	3
e.		SPARE	5	3
f.		SPARE	6	3
g.		SPARE	7	3
h.		SPARE	8	3

6.3.12.1.6 After 10 seconds has elapsed since step 6.3.12.1.2, enter the following into K-148:

```
VERB 21  NOUN 01    ENTR
00403    ENTR
00000    ENTR
```

6.3.12.1.7 Verify on CRT, page 20

VERB 21 NOUN 01
R1 00000
R3 00403

6.3.12.1.8 On K-148 enter the following sequence:

NOUN 15 ENTR
00000 ENTR ENTR (Push ENTR pushbutton twice)
Verify R1 = +00000
37777 ENTR ENTR
Verify R1 = 37777
37743 ENTR ENTR
Verify R1 = 37743
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR (once)
Verify R1 = 00000

6.3.12.1.9 Start analog recorders 4A1A3 and 4A3A2 using a chart speed of 10 mm/sec (IG - 360° TORQUE)

6.3.12.1.10 On K-148 enter the following sequence:

VERB 42 ENTR
VERB 33 ENTR

6.3.12.1.11 Monitor analog recorder 4A1A3. When the IG Torque Motor Current signal (GG2110) (Channel 1) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.1.12 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.12.1.13 On the CRT, page 20, lines 19, 20 and 21 verify CDU X, CDU Y, CDU Z all indicate +00000 (±00200).

6.3.12.1.14 After 10 seconds has elapsed since step 6.3.12.1.12 enter the following sequence into K-148:

VERB 21 NOUN 01 ENTR
00403 ENTR
00000 ENTR

6.3.12.1.15 Verify on CRT, page 20

VERB 21 NOUN 01
R1 00000
R3 00403

6.3.12.1.16 On K-148 enter the following sequence:

```
NOUN 15     ENTR
00000       ENTR      ENTR (Press ENTR pushbutton twice)
Verify Rl = 00000
40000       ENTR      ENTR
Verify Rl = 40000
40034       ENTR      ENTR
Verify Rl = 40034
00000       ENTR      ENTR
Verify Rl = 00000
00000       ENTR      (once)
Verify Rl = 00000
```

6.3.12.1.17 Start analog recorders 4A1A3 and 4A3A2 using a chart speed of 10 mm/sec (IG +360° TORQUE)

6.3.12.1.18 On K-148 enter the following sequence

```
VERB 42   ENTR
VERB 33   ENTR
```

6.3.12.1.19 Monitor analog recorder 4A1A3. When the IG Torque Motor Current signal (GG2110) (Channel 1) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.2 Outer Gimbal Friction Test

6.3.12.2.1 On K-148 enter the following sequence:

```
VERB 40   NOUN 20   ENTR   Wait 3 seconds
VERB 41   NOUN 20   ENTR
+00000    ENTR
+00000    ENTR
+00000    ENTR
```

6.3.12.2.2 On the CRT, page 20 lines 19, 20 and 21 verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.3 Set up analog recorder 4A1A3 to monitor the following:

	MEAS. NO.	SIGNAL NAME	RECORDER CHANNEL	ANALOG SELECT SWITCH POSITION
a.	GG2177	OG Servo Error In Phase	1	2
b.	GG2170	OG Torque Motor Current	2	2
c.	GG2166	OG Servo Error Total	3	2
d.	GG2280	OG CDU Fine Error	4	2
e.	GG 2172	OG 1x Resolver Sine	5	2
f.	GG2173	OG 1x Resolver Cosine	6	2
g.		SPARE	7	2
h.		SPARE	8	2

6.3.12.2.4 After 10 seconds has elapsed since step 6.3.12.2.1 enter the following sequence into K-148:

```
VERB 21     NOUN 01     ENTR
00403       ENTR
37777       ENTR
```

6.3.12.2.5 Verify as CRT, page 20

```
VERB 21     NOUN 01
R1          37777
R3          00403
```

6.3.12.2.6 On K-148 enter the following sequence:

```
NOUN 15     ENTR
377433      ENTR        ENTR   (Press ENTR pushbutton twice)
Verify R1 = 377433
00000       ENTR        ENTR
Verify R1 = 00000
00000       ENTR        ENTR
Verify R1 = 00000
00000       ENTR        ENTR
Verify R1 = 00000
00000       ENTR        (once)
Verify R1 = 00000
```

6.3.12.2.7 Start analog recorders 4A1A3 and 4A3A2 using a chart speed of 10 mm/sec. (OG - 360° TORQUE)

6.3.12.2.8 On K-148 enter the following sequence:

```
VERB 42     ENTR
VERB 33     ENTR
```

6.3.12.2.9 Monitor analog recorder 4A1A3. When the OG Torque Motor Current signal (GG2170) (Channel 2) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.2.10 On K-148 enter the following sequence:

```
VERB 40     NOUN 20     ENTR   Wait 3 seconds
VERB 41     NOUN 20     ENTR
+00000      ENTR
+00000      ENTR
+00000      ENTR
```

6.3.12.2.11 On the CRT, page 20 lines 19, 20 and 21 verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.12 After 10 seconds has elapsed since step 6.3.12.2.10, enter the following sequence into K-148.

VERB 21	NOUN 01	ENTR
00403	ENTR	
40000	ENTR	

6.3.12.2.13 Verify on CRT, page 20

VERB 21	NOUN 01
R1	40000
R3	00403

6.3.12.2.14 On K-148 enter the following sequence

NOUN 15	ENTR		
40034	ENTR	ENTR	(Push ENTR pushbutton twice)
Verify R1 = 40034			
00000	ENTR	ENTR	
Verify R1 = 00000			
00000	ENTR	ENTR	
Verify R1 = 00000			
00000	ENTR	ENTR	
Verify R1 = 00000			
00000	ENTR	(once)	
Verify R1 = 00000			

6.3.12.2.15 Start analog recorders 4A1A3 and 4A3A2 using a chart speed of 10 mm/sec (OG +360° TORQUE)

6.3.12.2.16 On K-148 enter the following sequence

VERB 42	ENTR
VERB 33	ENTR

6.3.12.2.17 Monitor analog recorder 4A1A3. When the OG Torque Motor Current signal (GG2170) (Channel 2) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.3 Middle Gimbal Friction Test

6.3.12.3.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+06750	ENTR		

6.3.12.3.2 On the CRT, page 20, lines 19, 20 and 21 verify CDU X = +00000 ±00200, CDU Y = +00000 ±00200, and CDU Z = +06750 ±00200.

6.3.12.3.3 Set up analog recorder 4A1A3 to monitor the following:

MEAS. NO.		SIGNAL NAME	RECORDER CHANNEL	ANALOG SELECT SWITCH POSITION
a.	GG2136	MG Servo Error Total	1	3
b.	GG2137	MG Servo Error In Phase	2	3
c.	GG2150	MG Torque Motor Current	3	3
d.	GG2143	MG 1x Resolver Cosine	4	3
e.	GG2250	MG CDU Fine Error	5	3
f.	GG2142	MG 1x Resolver Sine	6	3
g.		SPARE	7	3
h.		SPARE	8	3

6.3.12.3.4 After 10 seconds have elapsed since step 6.3.12.3.1, enter the following sequence into K-148:

VERB 21	NOUN 01	ENTR
00403	ENTR	
00000	ENTR	

6.3.12.3.5 Verify on CRT, page 20

VERB 21	NOUN 01
R1	00000
R3	00403

6.3.12.3.6 On K-148 enter the following sequence:

NOUN 15	ENTR	
00000	ENTR	ENTR (Press ENTR pushbutton twice)
Verify R1 = 00000		
00000	ENTR	ENTR
Verify R1 = 00000		
00000	ENTR	ENTR
Verify R1 = 00000		
14000	ENTR	ENTR
Verify R1 = 14000		
00000	ENTR	(once)
Verify R1 = 00000		

6.3.12.3.7 Start analog recorders 4A1A3 and 4A3A2 using a chart speed of 10 mm/sec. (MG - 135° TORQUE)

6.3.12.3.8 On K-148 enter the following sequence:

VERB 42 ENTR
VERB 33 ENTR

6.3.12.3.9 Monitor analog recorder 4A1A3. When MG Torque Motor Current (GG2150) (Channel 3) drops to a quiescent level (approximately 6 minutes), stop the recorders.

6.3.12.3.10 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
-06750 ENTR

6.3.12.3.11 On the CRT, page 20, lines 19, 20 and 21 verify CDU X = +00000 ±00200, CDU Y = +00000 ±00200, and CDU Z = -06750 ±00200.

6.3.12.3.12 After 10 seconds has elapsed since step 6.3.12.3.10, enter the following sequence into K-148:

VERB 21 NOUN 01 ENTR
00403 ENTR
00000 ENTR

6.3.12.3.13 On the CRT, page 20, verify

VERB 21 NOUN 01
R1 00000
R3 00403

6.3.12.3.14 On K-148 enter the following sequence:

NOUN 15 ENTR
00000 ENTR ENTR (Press ENTR pushbutton twice)
Verify R1 = 00000
00000 ENTR ENTR
Verify R1 = 00000
00000 ENTR ENTR
Verify R1 = 00000
63777 ENTR ENTR
Verify R1 = 63777
77777 ENTR (once)
Verify R1 = 77777

6.3.12.3.15 Start analog recorders 4A1A3 and 4A3A2 using a chart speed of 10 mm/sec. (MG + 135° TORQUE)

6.3.12.3.16 On K-148 enter the following sequence:

VERB 42 ENTR
VERB 33 ENTR

6.3.12.3.17 Monitor analog recorder 4A1A3. When the MG Torque Motor Current signal (GG2150) (Channel 3) drops to a quiescent level (approximately 6 minutes) stop the recorders.

6.3.12.3.18 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.12.4 **Test Analysis**

6.3.12.4.1 Remove the strip charts from analog recorders 4A1A3 and 4A3A2.

6.3.12.4.2 Examine each trace carefully to detect any shart discontinuities of the traces. Disregard all transients less that 0.5 second (5 mm) on any Torque Motor Current signal. Disregard all transients less than 0.2 second (2 mm) on any CDU Fine Error signal.

6.3.12.4.3 No Torque Motor Current signal on CH 4 shall ever exceed (0.125) amp. Sensitivity on recorder is 20 ma/division.

6.3.12.4.4 No CDU Fine Error on CH 3 shall ever exceed (.070) volts. Sensitivity on recorder is 50 mv/division.

6.3.13 Stabilization Loop Step Response Test

6.3.13.1 IG Response Test

6.3.13.1.1 On K-148 enter the following sequence:

VERB 40	NOUN 20	ENTR	Wait 3 seconds
VERB 41	NOUN 20	ENTR	
+00000	ENTR		
+00000	ENTR		
+00000	ENTR		

6.3.13.1.2 On CRT, page 16, line 20, verify IG MG, and OG platform between 358 and 002.

6.3.13.1.3 Set up analog recorder 4A1A3 to monitor the following:

	MEAS NO.	SIGNAL NAME	RECORDER CHANNEL	ANALOG SELECT SWITCH POSITION
a.	GG2110	IG Torque Motor Current	1	1
b.	GG2106	IG Servo Error Total	2	1
c.	GG2107	IG Servo Error In Phase	3	1
d.	GG2112	IG 1X resolver Sine	4	1
e.	GG2113	IG 1X Resolver Cosine	5	1
f.	GG2220	IG CDU Fine Error	6	1
g.	GG1201	IMU 28V 1 PCT 800 CPS	7	1
h.		SPARE	8	

6.3.13.1.4 On K-148 initiate FINE ALIGN by entering the following sequence:

VERB 42	ENTR
+00000	ENTR
+00000	ENTR
+00000	ENTR

6.3.13.1.5 On the CRT, page 20, lines 19, 20 and 21 verify CDU X, CDU Y and CDU Z indicate + 00000 ±00200.

CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU Operate Power.

6.3.13.1.6 Enter 1000 into 4A2A6-R-START 155. The top part of the switch shall be illuminated. Insure that no other function switches on 4A2A6-R155 are illuminated.

6.3.13.1.7 Press XEQ/SEAL pushbutton on 4A2A6-R-155 to enter the DC step voltage into the IG stabilization loop.

6.3.13.1.8 Prepare to start analog recorder 4A1A3 at a chart speed of 100 mm/sec. (IG RESPONSE TEST)

6.3.13.1.9 Enter 0000 into 4A2A6-R-START 155. The top part of the switch shall be extinguished. Insure that no other function switches on 4A2A6-R-155 are illuminated. Start analog recorder 4A1A3. Press the XEQ/SEAL pushbutton to remove the step input to the IG stabilization loop.

6.3.13.1.10 After the transient on Channel 3 of the recorder has died out, stop the recorder.

6.3.13.1.11 From Channel 3 of the analog recorder 4A1A3, verify the time interval between the removal of the step input and the peak magnitude of the first overshoot is no greater than 0.2 second. Verify there are no more than 2 overshoots.

6.3.13.2 MG Response Test.

6.3.13.2.1 Set up analog recorder 4A1A3 to monitor the following:

MEAS. NO.	SIGNAL NAME	RECORDER CHANNEL	ANALOG SELECT SWITCH POSITION
a. GG2136	MG Servo Error Total	1	3
b. GG2137	MG Servo Error In Phase	2	3
c. GG2140	MG Torque Motor Current	3	3
d. GG2143	MG 1X Resolver Cosine	4	3
e. GG2250	MG CDU Fine Error	5	3
f. GG2142	MG 1X Resolver Sine	6	3
g. GG1201	IMU 28V 1% 800 cps	7	1
h.	SPARE	8	

6.3.13.2.2 On the CRT, page 20, lines 19, 20 and 21 verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).

CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU Operate power.

6.3.13.2.3 Enter 0100 into 4A2A6-R-START 155. The top part of the switch shall be illuminated. Insure that no other function switches on 4A2A6-R155 are illuminated. Press XEQ/SEAL pushbutton on 4A2A6-R155 to enter the DC step voltage into the MG stabilization loop.

6.3.13.2.4 Prepare to start analog recorder 4A1A3 at a chart speed of 100 mm/sec. (MG RESPONSE TEST).

6.3.13.2.5 Enter 0000 into 4A2A6-R-START 155. The top part of the switch shall be extinguished. Insure that no other function switches on 4A2A6-R-155 are illuminated. Start analog 4A1A3. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.

6.3.13.2.6 After the transient on Channel 2 of the recorder has died out, stop the recorder.

6.3.13.2.7 From Channel 2 of 4A1A3, verify the time interval between the removal of the step input and the peak magnitude of the first overshoot is no greater than 0.2 seconds. Verify there are no more than 2 overshoots.

6.3.13.3 OG Response Test

6.3.13.3.1 Set up analog recorder 4A1A3 to monitor the following:

MEAS. NO.		SIGNAL NAME	RECORDER CHANNEL	ANALOG SELECT SWITCH POSITION
a.	GG2167	OG Servo Error In Phase	1	2
b.	GG2170	OG Torque Motor Current	2	2
c.	GG2166	OG Servo Error Total	3	2
d.	GG2280	OG CDU Fine Error	4	2
e.	GG2172	OG 1X Resolver Sine	5	2
f.	GG2173	OG 1X Resolver Cosine	6	2
g.	GG1201	IMU 28V 1% 800 cps	7	1
h.		SPARE		

6.3.13.3.2 On the CRT, page 20, lines19, 20 and 21 verify CDU X, CDU Y and CDU Z indicate +00000 (±00200)

CAUTION: If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU Operate power.

6.3.13.3.3 Enter 0010 into 4A2A6-R-START 155. The top part of the switch shall be illuminated. Insure that no other function switches on 4A2A6-R-155 are illuminated. Press XEQ/SEAL pushbutton on 4A2A6-R-155 to enter the DC step voltage into the OG stabilization loop.

6.3.13.3.4 Prepare to start analog recorder 4A1A3 at a chart speed of 100 mm/sec. (OG RESPONSE TEST).

6.3.13.3.5 Enter 0000 into 4A2A6-R-155. The top part of the switch shall be extinguished. Insure that no other function switches on 4A2A6-R-155 are illuminated. Start analog recorder 4A1A3. Press XEQ/SEAL pushbutton to remove the step input to the OG stabilization loop.

6.3.13.3.6 After the transient on Channel 1 of the recorder has died out, stop the recorder.

6.3.13.3.7 From Channel 1 of 4A1A3, verify the time interval between the removal of the step input and the peak magnitude of the first overshoot is no greater than 0.2 seconds. Verify there are no more than 2 overshoots.

6.3.13.3.8 On K-148 enter the following sequence:

```
VERB 41    NOUN 20    ENTR
+00000     ENTR
+00000     ENTR
+00000     ENTR
```

6.3.14 Gyrocompassing Test

6.3.14.1 Insure that the IMU Operate power and LGC Operate power has been applied for a minimum of one hour and that the IMU is not in a Gimbal Lock condition.

6.3.14.2 On K-148 enter the following sequence:

VERB 57 ENTR
00006 ENTR

6.3.14.3 VERB 06 NOUN 61 shall flash.

6.3.14.4 On the CRT, page 20, Row 1 shall display Launch Azimuth.

6.3.14.5 If value for Row 1 is correct, proceed to the next step. If value for Row 1 is incorrect, enter the following into K-148:

VERB 21 ENTR
±XXXXX ENTR Correct launch azimuth

Verify value in Row 1 is correct.

6.3.14.6 On K-148 enter the following:

VERB 33 ENTR

6.3.14.7 VERB 06 NOUN 61 shall flash.

6.3.14.8 On the CRT, page 20, Row 1 and Row 2 shall display Navigation Base Azimuth and Latitude, respectively.

6.3.14.9 If the values for Row 1 and Row 2 are correct, proceed to the next step. If the values for Row 1 or Row 2 are incorrect, enter the following into K-148.

If Row 1 is incorrect: VERB 21 ENTR
±XXXXX ENTR (Correct Nav Base Azimuth)

If Row 2 is incorrect: VERB 22 ENTR
+XX.XXX ENTR (Correct Site Latitude)

Verify values for Row 1 and Row 2 are correct.

6.3.14.10 On K-148 enter the following:

VERB 33 ENTR
VERB 16 NOUN 20

6.3.14.11 On the CRT, page 20, lines 19, 20 and 21 display CDU X, CDU Y and CDU Z angles, respectively.

6.3.14.12 After one hour has elapsed since step 6.3.14.10, read and record CDU X, CDUY and CDU Z angles.

6.3.14.13 On K-148 enter the following:

VERB 36 ENTR

6.3.14.14 Repeat steps 6.3.14.2 through 6.3.14.12

6.3.14.15 The OG angle obtained in step 6.3.14.12 shall not differ from that obtained in step 6.3.14.14 by more than ±0.25 deg.

6.3.14.16 The IG and MG angles obtained in step 6.3.14.12 shall not differ from those obtained in step 6.3.14.14 by more than ±0.10 deg.

6.3.14.17 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.15 **Fine Alignment Test**

NOTE: This test shall normally be made after completion of the AOT Functional Accuracy Test (6.3.16).

6.3.15.1 **AOT Line of Sight Determination**

6.3.15.1.1 Place the AOT in Detent Position L (-60°)

6.3.15.1.2 While sighting through the AOT, have a theodolite, hereafter called target #1, moved on the tooling bar until it lies in the proper target area as defined in Figure 1.

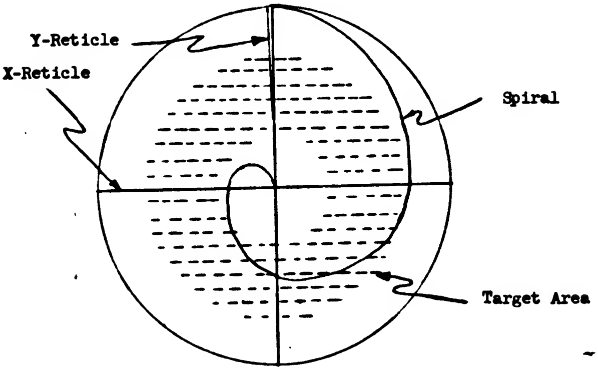


FIGURE 1.

View through AOT. The target should lie somewhere in the region represented by the shaded area (from 1/4 to 3/4 of the distance from the center to the edge of the field of view.

6.3.15.1.3 Place a light source in back of the AOT (on the eyepiece side) so as to be visible to the theodolite through the AOT.

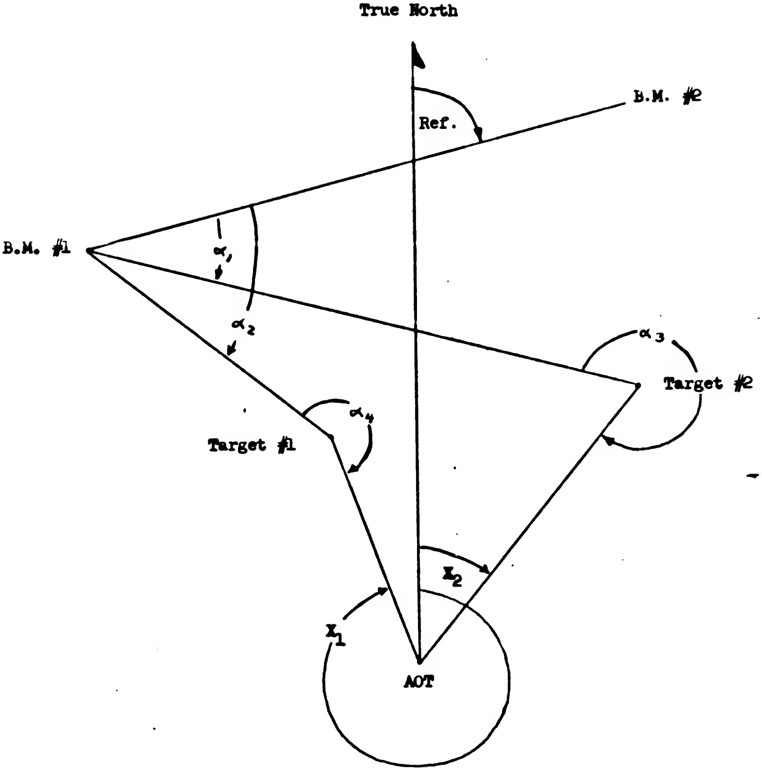
6.3.15.1.4 Level the theodolite at target #1.

6.3.15.1.5 Adjust the azimuth and elevation angles of the theodolite at target #1 until the light source backlighted through the AOT is in the center of the theodolites field of view. Read and record azimuth and elevation angles of theodolite #1.

6.3.15.1.6 Remove the light source from behind the AOT. While sighting through the AOT, rotate the reticle pattern until the Y reticle line and the center of target #1 intersect. Read and record the micrometer dial setting.

6.3.15.1.7 Rotate the reticle pattern of the AOT until the Spiral and the center of target #1 intersect. Read and record the micrometer dial setting.

Typical Fine Alignment Equipment Configuration



6.3.15.1.8 Place the AOT in Detent Position F (0°).

6.3.15.1.9 While sighting through the AOT, have a second theodolite, hereafter called target #2, moved on the tooling bar until it lies in the proper target area as defined in Figure 1.

6.3.15.1.10 Repeat steps 6.3.15.1.3 through 6.3.15.1.7 for target #2.

6.3.15.1.11 Place a third theodolite directly over a known benchmark, hereafter called B.M. #1.

6.3.15.1.12 Backsight the theodolites at B.M. #1 and target #1 on each other. Read and record each azimuth angle.

6.3.15.1.14 Sight the theodolite at B.M. #1 onto a second benchmark, hereafter called B.M. #2. The azimuth between B.M. #1 and B.M. #2 shall be known with respect to true north. Read and record the azimuth angle on the theodolite at B.M. #1.

6.3.15.1.15 From the previous data, calculate the azimuth and elevation angles from the AOT to target #1 and target #2. Each AOT azimuth angle shall be the positive angle measured clock wise from north. The following typical example is representative of the calculation procedure to be followed.

6.3.15.2 Typical Data Sheet used in sample calculations.

Ref. Azimuth from B.M. #1 to B.M. #2 is +74° 40'0" clockwise from true north.

Step Data Obtained	Data Source	Target	Assumed (Data)
a. 6.3.15.1.5	Target #1 Theod.	AOT	Azimuth = 120°30'0"
b.			Elevation = 45°1'0"
c. 6.3.15.1.6	AOT	Target #1	Y ROT = +27065
d. 6.3.15.1.7	AOT	Target #1	S ROT = +17505
e. 6.3.15.1.10	Target #2 Theod.	AOT	Azimuth = 267°20'0"
f.			Elevation = 45°2'0"
g.	AOT	Target #2	Y ROT = +07620
h.			S ROT = +31570
i. 6.3.15.1.12	Target #1 Theod.	B.M. #1	Azimuth = 267°55'0"
j.	B.M. #1 Theod.	Target #1	Azimuth = 71°40'0"
k. 6.3.15.1.13	Target #2 Theod.	B.M. #1	Azimuth = 330°50'0"
l.	B.M. #1 Theod.	Target #2	Azimuth = 20°55'0"
m. 6.3.15.1.14	B.M. #1 Theod.	B.M. #2	Azimuth = 20°55'0"
n. Mfgr's Detent L	Azimuth Angle	(for 6.3.15.3.3)	-60°5'35" = -060.09°
o. Mfgr's Detent F	Azimuth Angle	(for 6.3.15.3.5)	-0°12'42" = -000.21°
p. Mfgr's Detent R	Azimuth Angle	(for 6.3.15.3.7)	+59°46'17" = +059.77°
q. Mfgr's Detent L	Elevation Angle	(for 6.3.15.3.9)	+44°40'50" = +044.67°
r. Mfgr's Detent F	Elevation Angle	(for 6.3.15.3.11)	+45°0'10" = 045.00°
s. Mfgr's Detent R	Elevation Angle	(for 6.3.15.3.13)	+46°10'15" = +046.17'

6.3.15.2 Sample Calculations. The following calculations are from assumed values of data for the purpose of showing the procedure to be followed. Under no circumstances should the following numerical data be used in the actual test.

6.3.15.2.1

Target #1 azimuth with respect to true north = X_1

$$X_1 = \mathrm{REF} + \alpha_2 + \alpha_4$$

$$\alpha_2 = j - m = 71^\circ 40'0'' - 20^\circ 55'0'' = +50^\circ 45'0''$$

$$\alpha_4 = a - i = 120^\circ 30'0'' - 267^\circ 55'0'' = -147^\circ 25'0''$$

$$\therefore X_1 = 74^\circ 40'0'' + 50^\circ 45'0'' + (-147^\circ 25'0'') = +336^\circ 120'0'' = +338.00$$

Target #1 azimuth angle = +33800

6.3.15.2.2 for 6.3.15.4.6
Target #1 elevation angle
from 6.3.15.1.5, elevation = +45°1'0" = +45.0166° = +45017

6.3.15.2.3 for 6.3.15.4.8
Target #2 azimuth with respect to true north = X_2
X_2 = REF. + α_1 + α_3

α_1 = 1 - m = 48°38'0" − 20°55'0" = 27°35'0"

α_3 = e-k = 267°20'0" - 330°50'0" = -63°30'0"

∴ X_2 = 74°40'0" +27°35'0" - 63°30'0" = +38°45'0" = +038.75

Target #2 azimuth angle = +03875

6.3.15.2.4 for 6.3.15.4.8
Target #2 elevation angle
from 6.3.15.1.10, elevation = +45°2'0" = +45.033° = +45033

6.3.15.2.5 for 6.3.15.4.13
Modified Y ROT angle, target #1 = 6.3.15.2-c-Mfgr's Detent L Azimuth Angle + Mfgr's Detent F Azimuth Angle
from 6.3.15.2-c +270.65° = +270.65
from 6.3.15.3.3 (assume Mfgr's Detent LAz) = -60°5'35" = -060.09
from 6.3.15.3.5 (assume Mfgr's Detent FAz) = -0°12'42" = -000.21
∴ +270.65
−(-060.09)
+330.74
+(-000.21)
+ 330.53 = entry for 6.3.15.4.13 (Mod Y ROT, Tgt. #1)

6.3.15.2.6 for 6.3.15.4.13
Modified S ROT Angle, Target #1 = 6.3.15.2-d - Mfgr's Detent L Azimuth angle + Mfgr's Detent F Azimuth Angle
from 6.3.15.2-d = +17505 - +175.05
from 6.3.5.3.3 = -60°5'35" = -060.09
from 6.3.15.3.5 = -0°12'42" = -000.21
∴ +175.05
- (-060.09)
+235.14
+ (-000.21)
+ 234.93 = entry for 6.3.15.4.13 (Mod S ROT, Tgt. #1)

6.3.15.2.7 for 6.3.15.4.17
Modified Y ROT Angle, Target #2 = Y ROT angle, Target #2 from 6.3.15.2-g (+07620). (No modification is required.)

6.3.15.2.8 for 6.3.15.4.17
Modified S ROT, Angle, Target #2 = S ROT. Angle, Target #2
from 6.3.15.2-h (+31570). (No modification is required)

6.3.15.3 The computer shall be loaded with the corrected azimuth and elevation angles of each detent position from the manufacturers calibration data. This is done in the following manner.

6.3.15.3.1 Verify the G&N System is operating in the Operate mode as defined in sequence 6.2.4.13.

6.3.15.3.2 On K-148 enter the volloving
VERB 21 NOUN 03 ENTR
1462 ENTR
On the CRT, page 20, verify VERB 21 NOUN 03 is flashing and that R3 = 01462.

6.3.15.3.3 On K-148 enter the following
-XXX.XX ENTR (Mfgr's Detent L Azimuth from 6.3.15.2-n)
On the CRT, page 20 line 2, verify R1 = -XXX.XX

6.3.15.3.4 On K-148 enter the following
ENTR (VERB 21 NOUN 03 shall flash)
1463 ENTR
On the CRT, page 20 line 4, verify R3 - 01463

6.3.15.3.5 On K-148 enter the following
±XXX.XX ENTR (Mfgr's Detent F Azimuth from 6.3.15.2-o)
On the CRT, page 20 line 20, verify R1 = ± XXX.XX

6.3.15.3.6 On K-148 enter the following
ENTR
1464 ENTR
On the CRT, page 20 line 4, verify R3 = 01464

6.3.15.3.7 On K-148 enter the following
+XXX.XX ENTR (Mfgr's Detent R Azimuth from 6.3.15.2-p)
On the CRT, page 20 line 2, verify R1 = +XXX.XX

6.3.15.3.8 On K-148 enter the following
ENTR
1465 ENTR
On the CRT, page 20 line 4, verify R3 = 01465

6.3.15.3.9 On K-148 enter the following
+XXX.XX ENTR (Mfgr's Detent L Elevation from 6.3.15.2-q)
On the CRT, page 20 line 2, verify R1 = +XXX.XX

6.3.15.3.10 On K-148 enter the following
ENTR
1466 ENTR
On the CRT, page 20 line 4, verify R3 = 01466

6.3.15.3.11 On K-148 enter the following
+XXX.XX ENTR (Mfgr's Detent F Elevation from 6.3.15.2-r)
On the CRT, page 20 line 2, verify R1 = +XXX.XX

6.3.15.3.12 On K-148 enter the following
ENTR
1467 ENTR
On the CRT, page 20 line 4, verify R3 = 01467

6.3.15.3.13 On K-148 enter the following
+XXX.XX ENTR (Mfgr's Detent R Elevation from 6.3.15.2-s)
On the CRT, page 20 line 2, verify R1 = +XXX.XX

6.3.15.4 The G&N System shall have been operating in Operate mode at least one hour before proceeding with this test.

6.3.15.4.1 On K-148 enter the following
VERB 57 ENTR
00003 ENTR

6.3.15.4.2 On the DSKY, verify PROG 07 is displayed and that VERB 06 NOUN 61 is flashing.

6.3.15.4.3 On the CRT, page 20 lines 2-3, R1 shall indicate +13500 (SM Azimuth) and R2 shall indicate +XX.XXX (Site Latitude).
If the above values are correct, proceed to the next step.
If the values for R1 or R2 are incorrect, enter the following into K-148
If R1 is incorrect: VERB 21 ENTR
+13500 ENTR
If R2 is incorrect: VERB 22 ENTR
+XX.XXX ENTR (Site Latitude)
Verify the values for R1 and R2 are correct.

6.3.15.4.4 On K 148 enter the following
VERB 33 ENTR
On the CRT, page 20, verify VERB 21 NOUN 30 is flashing.

6.3.15.4.5 On K-148 enter the following
+00001 ENTR (Fine Alignment Test Position #1)
+00000 ENTR (using AOT)

6.3.15.4.6 On the CRT, page 20, verify VERB 06 NOUN 61 is flashing.
On the CRT, page 20 lines 2-3-4, the following shall be displayed .
R1 = +XXX.XX Target #1 Azimuth angle with respect to true north (from step 6.3.15.2.1 of calculations).
R2 = +XX.XXX Target #1 Elevation angle (from step 6.3.15.2.2 of calculations)
R3 = 00001 (indicating Target #1)
If the values for R1, R2 and R3 are correct, proceed to the next step.
If the values for R1, R2 or R3 are incorrect, enter the following into K-148.
If R1 is incorrect: VERB 21 ENTR
+XXX.XX ENTR (Target #1 Azimuth angle from step 6.3.15.2.1 of calculations)
If R2 is incorrect; VERB 22 ENTR
+XX.XXX (Target #1 Elevation angle from step 6.3.15.2.2 of calculations)
If R3 is incorrect: VERB 22 ENTR
00001 ENTR
Verify the values for R1, R2 and R3 are correct.

6.2.14.3.7 On K-148 enter the following
VERB 33 ENTR

6.3.15.4.8 On the CRT, page 20, verify VERB 06 NOUN 61 is flashing.
On the CRT, page 20 lines 2-3-4, the following shall be displayed.
R1 = +XXX.XX Target #2 Azimuth angle with respect to true north (from step 6.3.15.2.3 of calculations)
R2 = +XX.XXX Target #2 Elevation angle (from step 6.3.15.2.4 of calculations)
R3 = 00002 (indicating Target #2)
If the values for R1, R2 and R3 are correct, proceed to the next step.
If the values for R1, R2 or R3 are incorrect, enter the following into K-148.
If R1 is incorrect: VERB 21 ENTR
+XXX.XX ENTR (Target #2 Azimuth angle from step 6.3.15.2.3 of calculations)
If R2 is incorrect: VERB 22 ENTR
+XX.XXX ENTR (Target #2 Elevation angle from step 6.3.15.2.4 of calculations)
If R3 is incorrect: VERB 23 ENTR
00002 ENTR
Verify the values for R1, R2 and R3 are correct

6.3.15.4.9 On K-148 enter the following
VERB 33 ENTR

6.3.15.4.10 On the CRT, page 20, verify VERB 51 is flashing and that R1 = 00001.

6.3.15.4.11 On the computer control and Reticle Dimming Assembly, press MARK X pushbutton.

6.3.15.4.12 On K-148 enter the following
(VERB 21 NOUN 30 shall flash)
00000 ENTR (VERB 21 NOUN 43 shall flash)
+00001 ENTR (VERB 21 NOUN 42 shall flash)
+XXX.XX ENTR (Modified Y ROT angle Tgt. #1 from step 6.3.15.2.5 of calculations)
(VERB 22 NOUN 42 shall flash)
+XXX.XX ENTR (Modified S ROT angle, Tgt #1 from step 6.3.15.2.6 of calculations)

6.3.15.4.13 On the CRT, page 20, verify VERB 51 is flashing and R1 = 00002.

6.3.15.4.14 On the computer control and Reticle Dimming Assembly, press MARK X pushbutton.

6.3.15.4.15 On K-148 enter the following
(VERB 21 NOUN 30 shall flash)
00000 ENTR (VERB 21 NOUN 43 shall flash)
00002 ENTR (VERB 21 NOUN 42 shall flash)
+XXX.XX ENTR (Modified Y ROT. angle, Tgt. #2 from step 6.3.15.2.7 of calculations.)
(VERB 22 NOUN 42 shall flash)
+XXX.XX ENTR (Modified S ROT angle, Tgt. #2 from step 6.3.15.2.8 of calculations)

6.3.15.4.16 After approximately 100 seconds, on the CRT, page 20, VERB 51 shall flash and R1 = 00001. Repeat steps 6.3.5.4.11 through 6.3.15.4.15.

6.3.15.4.17 After approximately 7 minutes VERB 06 NOUN 66 shall flash. On the CRT, page 20 lines 2-3, read and record Y PIPA misalignment (including Y PIPA bias) about Z axis.
R1 indicates whole part, R2 indicates fractional part in units of arc seconds.

6.3.15.4.18 On K-148 enter the following
VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.15.4.19 On the CRT, page 20 lines 2-3, read and record Z PIPA misalignment (including Z PIPA bias) about Y axis. R1 is whole part, R2 is fractional part in units of arc seconds.

6.3.15.4.20 On K-148 enter the following
VERB 34 ENTR

6.3.15.5 On K-148 initiate the Fine Alignment test in position #2 by entering the following
VERB 57 ENTER
00003 ENTR

6.3.15.5.1 On the DSKY, verify PROG 07 is displayed and that VERB 06 NOUN 61 is flashing.

6.3.15.5.2 On the CRT, page 20 lines 2-3, verify R1 = +13500 and R2 = ±XX.XXX (Site Latitude)
If the values for R1 and R2 are correct, proceed to the next step
If the values for R1 or R2 are incorrect, enter the following into K-148
If R1 is incorrect: VERB 21 ENTR
+13500 ENTR
If R2 is incorrect: VERB 22 ENTR
+XX.XXX ENTR (Site Latitude)
Verify the values for R1 and R2 are correct.

6.3.15.5.3 On K-148 enter the following
VERB 33 ENTR
On the CRT, page 20, verify VERB 21 NOUN 30 is flashing.

6.3.15.5.4 On K-148 enter the following
+00002 ENTR (Fine Alignment Test Position #2)
+00000 ENTR (using AOT)

6,3.15.5.5 Repeat steps 6.3.15.4.6 through 6.3.15.4.17.

6.3.15.5.6 After approximately 7 minutes, VERB 06 NOUN 66 shall flash. On the CRT, page 20 lines 2-3, read and record X PIPA misalignment (including X PIPA bias) about Y axis. R1 indicates whole part, R2 indicates fractional part in units of arc seconds.

6.3.15.5.7 On K-148 enter the following
VERB 33 ENTR
VERB 06 NOUN 66 shall flash

6.3.15.5.8 On the CRT, page 20 lines 2-3, read and record Y PIPA misalignment (including Y PIPA bias) about X axis. R1 is whole part, R2 is fractional part in units of arc seconds.

6.3.15.5.9 Terminate the test by entering in K-148 the following
VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.3.15.6 Results
The PIPA bias, determined previously in the IMU Performance Test (6.3.9) must be deducted from the resultant data of this test.

6.3.15.6.1 from 6.3.15.4.19
Y PIPA misalignment (including bias) (R1) (R2)
about Z axis = ±XXXXX.XXXXX sec
less Y PIPA bias (from 6.3.9) - (±XXXXX.XXXXX) sec
Y PIPA misalignment about Z axis =
This shall not exceed ± 200 arc sec.

6.3.15.6.2 from 6.3.15.4.21
Z PIPA misalignment (including bias) (R1) (R2)
about Y axis = ±XXXXX.XXXXX sec
less Z PIPA bias (from 6.3.9) = -(±XXXXX.XXXXX)sec
Z PIPA misalignment about Y axis =
This shall not exceed ± 200 arc sec.

6.3.15.6.3 from 6.3.15.5.6
X PIPA misalignment (including bias) (R1) R2)
about Y axis = ±XXXXX.XXXXX
less X PIPA bias (from 6.3.9) = - (±XXXXX.XXXXX)
X PIPA misalignment about Y axis =
This shall not exceed ± 200 arc sec.

6.3.15.6.4 from 6.3.15.5.8
Y PIPA misalignment (including bias) (R1) (R2)
about X axis = ±XXXXX.XXXXX
less Y PIPA bias = - (±XXXXX.XXXXX)
Y PIPA misalignment about X axis =
This shall not exceed ± 200 arc sec.

6.3.16 AOT FUNCTIONAL ACCURACY

6.3.16.1 Determination of Detent angles (Theodolites)

6.3.16.1.1 Place the AOT in detent position F.

NOTE: Provisions for communication between the AOT and theodolite operators are required.

6.3.16.1.2 While viewing through the AOT, instruct the theodolite "F" operator to translate vertically and laterally until the target lies approximately in the center of the AOT reticle.

6.3.16.1.3 Instruct the theodolite "F" operator to adjust the target in azimuth and elevation until the target cross hairs are centered with respect to the AOT reticle.

CAUTION: The theodolite must be precisely level when alignment is achieved.

6.3.16.1.4 When alignment is accomplished, set the theodolite azimuth to exactly 0°00'00". Read and record this value and the elevation angle as measured from horizontal.

6.3.16.1.5 Rotate theodolite "F" clockwise approximately 90° and in elevation to autocollimate with theodolite "L". Read and record the azimuth of theodolite "F".

6.3.16.1.6 Set the azimuth scale of theodolite "L" to precisely 0°00'00" while it is autocollimated with theodolite "F".

6.3.16.1.7 Set the AOT in detent position "L".

6.3.16.1.8 While viewing through the AOT, instruct theodolite "L" operator to adjust the azimuth and elevation of the instrument until the full aperture of the target is visible.

NOTE: The target will appear in the lower right hand quadrant of the AOT field of view. Do not translate the theodolite.

6.3.16.1.9 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record the azimuth and elevation of theodolite "L". Read and record the AOT counter value. Repeat the AOT reading three times and average the results.

6.3.16.1.10 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double lines of the spiral reticle.

CAUTION: Use extreme care to assure that centering is accomplished. Read and record the AOT counter value. Repeat the reading three times and average the results.

6.3.16.1.11 Move theodolite "F" to the stop on the tooling bar which is the position for theodolite "R".

6.3.16.1.12 Rotate theodolite "L" in elevation and counter clockwise in azimuth until autocollimation with theodolite "R" is accomplished. Set the azimuth scale of theodolite "R" to precisely 0°00'00".

6.3.16.1.13 While viewing through the AOT, instruct theodolite "R" operator to move the target in azimuth and elevation until the full aperture is visible.

NOTE: The target will appear in the lower left hand quadrant of the AOT field. Do not translate the theodolite.

6.3.16.1.14 Rotate the AOT control knob until superposition of the target between the Y reticle lines is accomplished. Read and record the theodolite "R" azimuth and elevation. Read and record the AOT counter value three times and average the results.

6.3.16.1.15 Rotate the AOT reticle until the center of the target is superimposed with the spiral. Read and record the AOT counter value three times and average the results.

6.3.16.1.16 Using the values measured in the above steps and as shown in Exhibit 3 below, compute angles X_1 and X_2 from:

$$X_1 = \cos^{-1} \sin \phi_1 \sin \phi_2 + \cos \phi_1 \cos \phi_2 \cos \; 180-(\alpha_1 + \alpha_2)$$

$$X_2 = \cos^{-1} \sin \phi_1 \sin \phi_3 + \cos \phi_1 \cos \phi_3 \cos \; 180-(\alpha_3 + \alpha_4)$$

Where:

α_1 = azimuth value, step 6.3.16.1.9

α_2 = azimuth value, step 6.3.16.1.5

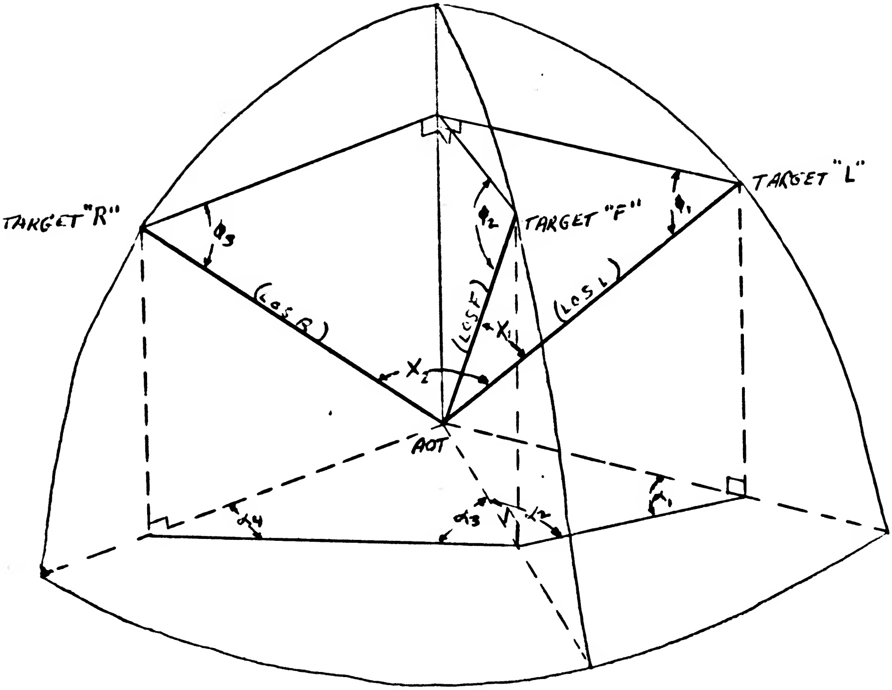
α_3 = azimuth value = $180 - \alpha_2$

α_4 = azimuth value, step 6.3.16.1.14

ϕ_1 = theodolite "L" elevation, step 6.3.16.1.9

ϕ_2 = theodolite "F" elevation, step 6.3.16.1.4

ϕ_3 = theodolite "R" elevation, step 6.3.16.1.14



AOT ACCURACY TEST

6.3.16.2 COMPUTER LOADING OF MANUFACTURER's DETENT

6.3.16.2.1 The G&N System shall be operated in Standby Mode.

6.3.16.2.2 On the CRT, page 15, line 5, verify that +28 VDC IMU OPERATE (OG 1500) power is off.

6.3.16.2.3 The computer shall be loaded with the corrected azimuth and elevation angles of each detent position obtained from the manufacturer's calibration data. This is done in the following manner.

6.3.16.2.4 On K-148 enter the following:

VERB 21 NOUN 03 ENTR
1462 ENTR

On the CRT, page 20, verify VERB 21 NOUN 03 is flashing and that R3 = 01462.

6.3.16.2.5 On K-148 enter the following:

-XXX.XX ENTR (Mfgr's Detent L. Azimuth Angle)

On the CRT, page 20, line 2, verify R1 = -XXX.XX

6.3.16.2.6 On K-148 enter the following:

ENTR (VERB 21 NOUN 03 shall flash)
1463 ENTR

On the CRT, page 20, line 4, verify R3 - 01463

6.3.10.2.7 On K-148 enter the following:

±XXX.XX ENTR (Mfgr's Detent F Azimuth Angle)

On the CRT, page 20, line 2, verify R1 = ±XXX.XX

6.3.16.2.8 On K-148 enter the following:

ENTR
1464 ENTR

On the CRT, page 20, line 4, verify R3 = 01464

6.3.16.2.9 On K-148 enter the following:

+XXX.XX ENTR (Mfgr's Detent R Azimuth Angle)

On the CRT, page 20, line 2, verify R1 = +XXX.XX

6.3.16.2.10 On K-148 enter the following:

ENTR
1465 ENTR

On the CRT, page 20, line 4, verify R3 = 01465

6.3.16.2.11 On K-148 enter the following:

+XXX.XX ENTR (Mfgr's Detent L Elevation Angle)

On the CRT, page 20, line 2, verify R1 = +XXX.XX

6.3.16.2.12 On K-148 enter the following:

ENTR
1466 ENTR

On the CRT, page 20, line verify R3 - 01466

6.3.16.2.13 On K-148 enter the following:

+XXX.XX ENTR (Mfgr's Detent F Elevation Angle)

On the CRT, page 20, line 2, verify R1 = +XXX.XX

6.3.16.2.14 On K-148 enter the following:

ENTR
1467 ENTR

On the CRT, page 20, line 4, verify R3 - 01467

6.3.16.2.15 On K-148 enter the following:

+XXX.XX ENTR (Mfgr's Detent R Elevation Angle)

On the CRT, page 20, line 2, verify R1 = +XXX.XX

6.3.10.3 CALCULATIONS

6.3.16.3.1 The following calculations shall be made separately by the K-START Operator and the Senior Engineer on the Low Boy. They shall be verified prior to entering the Y or S angle information into the computer.

6.3.16.3.2 For step 6.3.16.4.4 and 6.3.16.4.16 below, value to be entered into the computer is equal to:

Y-ROT. ANGLE, Tgt. "L" (from step 6.3.16.1.9) minus Mfgr's Detent L Azimuth Angle (from step 6.3.16.2.5) plus Mfgr's Detent F Azimuth Angle (from step 6.3.16.2.7)

6.3.16.3.3 For step 6.3.16.4.6 and 6.3.16.4.18 below, value to be entered into computer is equal to:

S-ROT. ANGLE, Tgt. "L" (from step 6.3.16.1.10) minus Mfgr's
Detent L Azimuth Angle (from step 6.3.16.2.5) plus Mfgr's
Detent F Azimuth Angle (from step 6.3.16.27)

6.3.16.3.4 For steps 6.3.16.4.9 and 6.3.16.4.11 below, there are no calculations involved and the entries are all zeros.

6.3.16.3.5 For step 6.3.16.4.21, value to be entered into compute is equal to:

Y-ROT. ANGLE, Tgt. "R" (from step 6.3.16.1.14) minus Mfgr's
Detent R Azimuth Angle (from step 6.3.16.2.9) plus Mfgr's
Detent F Azimuth Angle (from step 6.3.16.2.17)

6.3.16.3.6 for step 6.3.16.4.23 below, value to be entered into computer is equal to:

S-ROT. ANGLE, Tgt. "R" (from step 6.3.16.1.15) minus Mfgr's
Detent R Azimuth Angle (from step 6.3.16.2.9) plus Mfgr's
Detent F Azimuth Angle (from step 6.3.16.2.7).

6.3.16.4 COMPUTER DETERMINATION OF SIGHTING ANGLES

6.3.16.4.1 On K-148 enter the following:

VERB 57 ENTR
12 ENTR

6.3.16.4.2 On the CRT, page 20, verify VERB 51 is flashing and that R1 = 00001.

6.3.16.4.3 On the Computer Control and Reticle Dimming Assembly, press MARK X pushbutton

On the CRT, page 20, verify VERB 50 is displayed.

6.3.16.4.4 On K-148 enter the following:

ENTR (VERB 21 NOUN 30 shall flash on DSKY)
00000 ENTR (VERB 21 NOUN 43 shall flash on DSKY)
00001 ENTR (VERB 21 NOUN 42 shall flash on DSKY)
±XXX.XX ENTR (from step 6.3.16.3.2)

6.3.16.4.5 On CRT, page 20, line 3, verify R1 = ±XXX.XX (from step 6.3.16.3.2 - VERB 22 NOUN 42 shall flash).

6.3.16.4.6 On K-148 enter the following:

±XXX.XX ENTR (from step 6.3.16.3.3)

6.3.16.4.7 On CRT, page 20, verify VERB 51 is flashing, R1 = 00002 and R2 = ±XXX.XX (from step 6.3.16.3.3).

6.3.16.4.8 On the Computer Contsol and Reticle Dimming Assembly, press MARK X pushbutton.

6.3.16.4.9 On the CRT, page 20 verify VERB 50 is displayed
On K-148 enter the following:

ENTR (VERB 21 NOUN 30 shall flash on DSKY)
00000 ENTR (VERB 21 NOUN 43 shall flash on DSKY)
00002 ENTR (VERB 21 NOUN 42 shall flash on DSKY)
+000.00 ENTR (Y-ROT. ANGLE, Tgt. "F")

6.3.16.4.10 On the CRT, page 20, line 3, verify R1 = +000.00 (Y-ROT. ANGLE Tgt. "F"). (VERB 22 NOUN 42 shall flash).

6.3.16.4.11 On K-148 enter the following:

+000.00 ENTR (S-ROT. ANGLE, Tgt. "F").

6.3.16.4.12 On the CRT, page 20, line 3, verify R2 = +000.00 (S-ROT. ANGLE, Tgt. "F"). VERB 06 NOUN 03 shall be displayed. R1 shall display the LGC computed angle between Detent Positions L and F. Record R1. (±XXX.XX DEGREES).

6.3.16.4.14 On the CRT, page 20, verify VERB 51 is flashing, and that R1 = 00001,

6.3.16.4.15 On the Computer Control and Reticle Dimming Assembly press MARK X pushbutton.

6.3.16.4.16 On the CRT, page 20, verify VERB 50 is displayed.
On K-148 enter the following:

ENTR (VERB 21 NOUN 30 shall flash on DSKY).
00000 ENTR (VERB 21 NOUN 43 shall flash on DSKY).
00001 ENTR (VERB 21 NOUN 42 shall flash on DSKY).
±XXX.XX ENTR from 6.3.16.3.2

6.3.16.4.17 On the CRT, page 20, verify R1 = ±XXX.XX (from step 6.3.16.3.2). (VERB 22 NOUN 42 shall flash).

6.3.16.4.18. On K=148 enter the following:

±XXX.XX ENTR (from step 6.3.16.3.3).

6.3.16.4.19 On the CRT, page 20, verify VERB 51 is flashing. R1 = 00002 and R2 = ±XXX.XX (from step 6.3.16.3.3)

6.3.16.4.20 On the Computer Control and Reticle Dimming Assembly, press MARK X pushbutton.

6.3.16.4.21 On the CRT, page 20, verify VERB 50 is displayed. On K-148 enter the following:

ENTR (VERB 21 NOUN 30 shall flash on DSKY).
00000 ENTR (VERB 21 NOUN 43 shall flash on DSKY).
00003 ENTR (VERB 21 NOUN 42 shall flash on DSKY).
±XXX.XX ENTR (from step 6.3.16.3.5)

6.3.16.4.22 On the CRT, page 20, line 3, verify R1 = ±XXX.XX (from step 6.3.16.3.5). (VERB 22 NOUN 42 shall flash).

6.3.16.4.23 On K-148 enter the following:

±XXX.XX ENTR (from step 6.3.16.3.6)

6.3.16.4.24 On the CRT, page 20 line 3, verify R2 = ±XXX.XX (from step 6.3.16.3.6). VERB 06 NOUN 03 shall be displayed. R1 shall display the LGC computed angle between Detent Position L and R. Record R1. (±XXX.XX DEGREES).

6.3.16.5 TEST RESULTS

6.3.16.5.1 The LGC computed angle between Left and Forward Detent Positions, obtained in step 6.3.16.4.12 shall differ from X_1 (calculated in step 6.3.16.1.16) by no more than ±0.08 degrees.

6.3.16.5.2 The LGC computed angle between Left and Right Detent Positions, obtained in step 6.3.16.4.24 shall differ from X_2 (calculated in step 6.3.16.1.16) by no more than ±0.08 degrees.

APPENDIX I

MEASUREMENT TOLERANCES

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT
GG 1020	+14 VDC LGC Supply	14.0 ± 0.2 VDC
GG 1030	+4 VDC LGC Supply	4.0 ± 0.15 VDC
GG 1040	+120 VDC PIPA Supply	120 ± 6.0 VDC
GG 1070	+4 VDC CDU Supply	4.0 ± 0.2 VDC
GG 1100	-28 VDC Supply	-27.5 ± 6.0 VDC
GG 1110	2.5 VDC Telemetry Bias No. 1	2.5 ± 0.1 VDC
GG 1111	25 VDC Telemetry Bias No. 2	2.5 ± 0.1 VDC
GG 1201	IMU 28 V 800 CPS 1%	28 ± 0.56 VRMS
GG 1202	IMU 28 V 800 CPS 5%	28 ± 1.4 VRMS
GG 1203	IMU 28 V 800 CPS 5%	28 ± 2.1 VRMS
GG 1331	3.2 KC 28 V Supply 1%	28 ± 0.57 VRMS
GG 1331	3.2 KC 28 V Supply 1%	28 ± 0.57 VRMS
NG 1336B	PH Diff 3.2 KC 28 V Sys/LGC	N/A
GG 1500	+28 VDC IMU Oper BUSS	28.5 +0, -1 VDC
GG 1510	+28 VDC IMU STBY BUSS	28.0 ± 0.5 VDC
GG 1513X	+28 VDC IMU STBY/OFF	28.0 ± 1 VDC
GG 1520	+28 VDC LGC Oper BUSS	28.0 +4.5, -3.5 VDC
GG 1523X	+28 VDC LGC Operate	28.0 ± 1 VDC
GG 2001	X PIPA S.G. OUT In PH	+2.5 ± at 1g
GG 2021	X PIPA S.G. OUT IN PH	+2.5 ± at 1g
GG 2041	Z PIPA S.G. OUT IN PH	+2.5 ± at 1g

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT
GG 2106	IG Servo Error Total	0.0 ± 60 MVRMS at null
GG 2107	IG Servo Error IN PH	0.0 ± 60 MVRMS at null
GG 2110	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque
GG 2110	IG Torque Motor Current	0.5 AMP Max during any fine Align Torque
GG 2112	IG 1X Resolver Out-Sine	19.65 ± 0.98 VRMS at 45°
GG 2112 3	IG 1X Resolver Out-Cosine	19.65 ± 0.98 VRMS at 45°
GG 2121	IG 1X Resolver Out-Sine 11°	5.35 ± 0.27 VRMS at 11°
GG 2136	MG 1X Servo Error Total	0.0 ± 60 MVRMS at null
GG 2137	MG 1X Servo Error IN PH	0.0 ± 60 MVRMS at null
GG 2140	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque
GG 2140	MG Torque Motor Current	0.5 AMP Max during any fine Align Torque
GG 2142	MG 1X Resolver Out-Sine	19.65 ± 0.98 VRMS at 45°
GG 2143	MG 1X Resolver Out-Cosine	19.65 ± 0.98 VRMS at 45°
GG 2151	MG 1X Resolver Out-Sine 11°	5.35 ± 0.27 VRMS at 11°
GG 2166	OG Servo Error Total	0.0 ± 60 MVRMS at null
GG 2167	OG Servo Error IN PH	0.0 ± 60 MVRMS at null
GG 2170	OG Torque Motor Current	0.5 AMP Max during any fine Align Torque

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT
GG 2170	OG Torque Motor Current	0.5 AMP Max during any fine Align Torque
GG 2172	OG 1X Resolver Out-Sine	19.65 ± 0.98 VRMS at 45°
GG 2173	OG 1X Resolver Out-Cosine	19.65 ± 0.98 VRMS at 45°
GG 2181	OG 1X Resolver Out-Sine 11°	5.35 ± 0.27 VRMS at 11°
GG 2219	Pitch Attitude Error	5.05 ± 0.5 VRMS at 17°
GG 2220	IG CDU Fine Error	0.0 ± 0.07 VRMS at null
GG 2220	IG CDU Fine Error	0.0 ± 0.07 VRMS at null
GG 2221	IG CDU Coarse Error	0.0 ± 0.68 VRMS at null
GG 2249	YAW Attitude Error	5.05 ± 0.5 VRMS at 17°
GG 2250	MG CDU Fine Error	0.0 ± 0.07 VRMS at null
GG 2250	MG CDU Fine Error	0.0 ± 0.07 VRMS at null
GG 2251	MG CDU Coarse Error	0.0 ± 0.68 VRMS at null
GG 2279	Roll Attitude Error	5.05 ± 0.5 VRMS at null
GG 2280	OG CDU Fine Error	0.0 ± 0.07 VRMS at null
GG 2280	OG CDU Fine Error	0.0 ± 0.07 VRMS at null
GG 2281	OG CDU Coarse Error	0.0 ± 0.68 VRMS at null
GG 2300	PIPA Temperature	130 ± 2° F in Operate
GG 2301	IRIG Temperature	135 ± 2° F in Operate

SIGNAL	SIGNAL NAME	G&N LAB TEST REQUIREMENT
GG 2301	IRIG Temperature	135 ± 2° F in Operate
GG 2302	IMU Heater Current On	28 ± 1 VDC
GG 2302	IMU Heater Current	28 ± 1 VDC
GG 2303	IMU Blower Current On	28 ± 1V VDC
GG 2303	IMU Blower Current	28 ± 1V VDC
GG 3304	RR Shaft 1X Resolver Out-Sine	19.65 ± 0.98 VRMS at 45°
GG 3305	RR Shaft 1X Resolver Out-Cosine	19.65 ± 0.98 VRMS at 45°
GG 3311	RR Shaft CDU Fine Error	0.0 ± 0.07 VRMS at null
GG 3311	RR Shaft CDU Fine Error	0.0 ± 0.07 VRMS at null
GG 3312	RR Shaft CDU Coarse Error	0.0 ± 0.68 VRMS at null
GG 3321	RR Trunnion CDU Fine Error	0.0 ± 0.07 VRMS at null
GG 3321	RR Trunnion CDU Fine Error	0.0 ± 0.07 VRMS at null
GG 3322	RR Trunnion CDU Coarse Error	0.0 ± 0.68 VRMS at null
GG 3324	RR Trunnion 1X Resolver Out-Sine	19.65 ± 0.98 VRMS at 45°
GG 3325	RR Trunnion 1X Resolver Out-Cosine	19.65 ± 0.98 VRMS at 45°
GG 4300	LGC Temperature	75.0 ± 45° F
GG 6020	PIPA Calibration Module Temperature	57.5 ± 27.5° F
GG 6020	PIPA Calibration Module Temperature	57.5 ± 27.5° F
GG 6021	PSA Temperature	70.0 ± 40° F

6.2.19.19 After performing position 6 terminate test by inserting VERB 34 ENTER into K148.

6.2.19.20 Insert and verify the following sequence into K148:

a. VERB 41, NOUN 20, ENTER

b. +00000 ENTER

c. +00000 ENTER

d. +00000 ENTER

6.2.19.21 The data recorded for positions 1 through 6 when performing 6.2.19.11 has the following meaning:

Position	Displayed Drift Coefficients
1	+NBDY
2	+NBDZ
3	+NBDX
4	+NBDY + ADSRAY
5	+NBDZ + ADSRAZ
6	+NBDX + ADSRAX

6.2.19.22 The data recorded for positions 1 through 6 when performing 6.2.19.16 and 6.2.19.17 shall be utilized on the calculations sheets to derive the ADIA terms.

6.2.19.23 The following terms shall be solved for and have the following tolerances with respect to the last performance of JDC 15236, 15237, 15239, 15240, 15242, 15243 found in the G&N System Data Package:

NBD $\pm$ 00500 = $\pm$ 7 meru
ADSRA $\pm$ 01000 = $\pm$ 12 meru
ADIA $\pm$ 02000 = $\pm$ 20 meru

6.2.20.14 To correct R2 insert and verify the following into K148:

a.	VERB 22	ENTER
b.	+ 28516 (correct LAT)	ENTER
c.	VERB 33	ENTER

6.2.20.15 Observe VERB 21, NOUN 30 flashing, insert and verify 00001, ENTER into K148.

6.2.20.16 Observe VERB 51 flashing with R1 indicating 00001. Sight through SXT and align with TGT 1. Upon reticle coincidence, press MARK pushbutton. If satisfied with alignment, press ENTER pushbutton on DSKY. (If not satisfied with alignment, insert and verify VERB 52, ENTER into DSKY and repeat above procedure.)

6.2.20.17 Observe VERB 51 flashing with R1 indicating 00002. Sight through SXT and align with TGT 1. Upon reticle coincidence, press MARK pushbutton. If satisfied with alignment, press ENTER pushbutton on DSKY. (If not satisfied with alignment, insert and verify VERB 52, ENTER into DSKY and repeat above procedure.)

6.2.20.18 During approximately the next 3.5 minutes the following IMU moding will occur as indicated on the IMU CONTROL panel.

a. ZERO ENCODE
b. FINE ALIGN
c. ATTITUDE CONTROL
d. FINE ALIGN
e. COARSE ALIGN
f. FINE ALIGN

6.2.20.19 Repeat 6.2.20.16 and 6.2.20.17.

6.2.20.20 Approximately 7 minutes after the IMU enters the FINE ALIGN mode, VERB 06, NOUN 66 will flash. R1 (whole) and R2 (fractional) will contain the misalignment (arc sec) of the Y PIPA IA about the Z_{SM}. Record and insert VERB 33, ENTER. R1 (whole) and R2 (fractional) will contain the misalignment (arc sec) of the Z PIPA IA about the Y_{SM}. Record R1 and R2.

6.2.20.21 Insert and verify VERB 34, ENTER into K148.

6.2.20.22 Repeat 6.2.20.4 through 6.2.20.14.